621.384

APRIL 1958

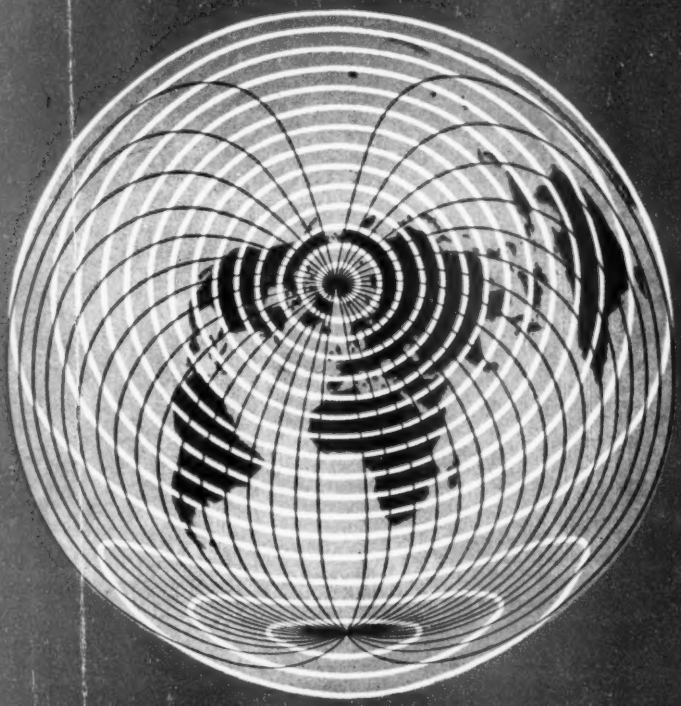
TWO SHILLINGS

Wireless World

ELECTRONICS

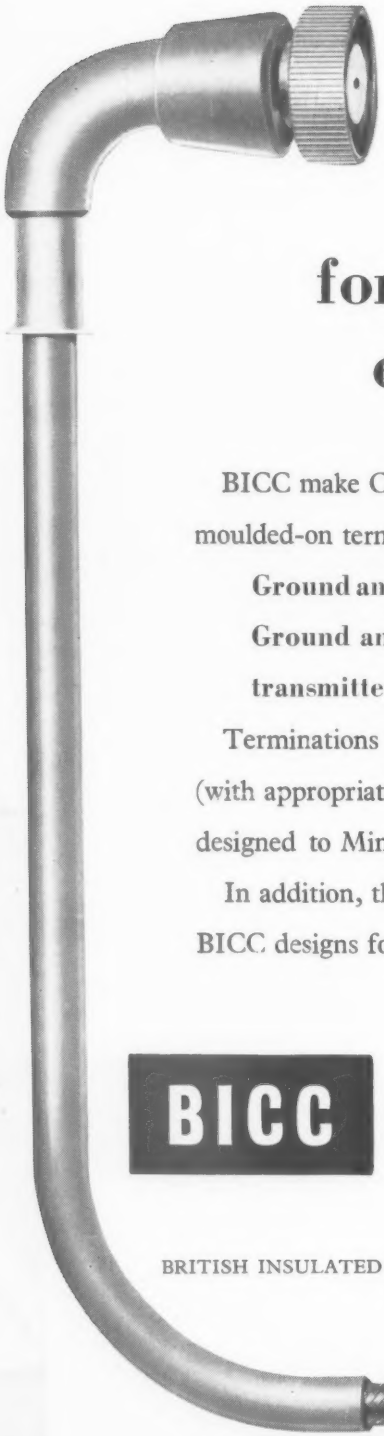
Radio · Television

RAE FARADAY LIBRARY
APR 8 1958



FORTY-EIGHTH YEAR OF PUBLICATION

XUM



for *interconnecting* electronic equipment

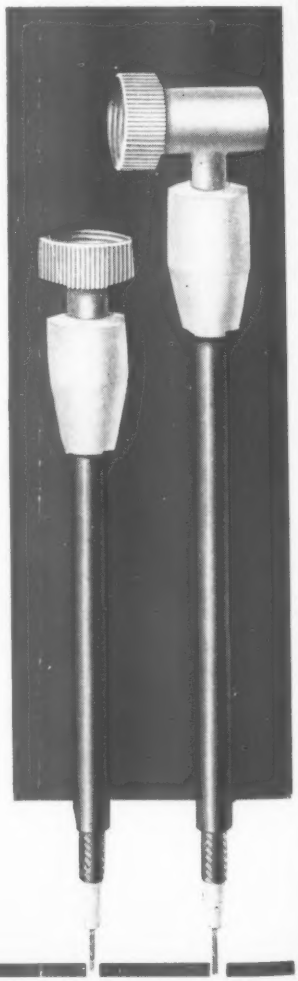
BICC make Coaxial Radio Frequency Connectors with moulded-on terminations for use with—

Ground and airborne radar equipment

Ground and airborne radio transmitters and receivers

Terminations include a standard range (with appropriate panel mounting units) designed to Ministry of Supply requirements.

In addition, there are a number of BICC designs for other applications.



BICC *coaxial* **R. F. CONNECTORS**

BRITISH INSULATED CALLENDER'S CABLES LIMITED,
21 Bloomsbury Street, London, W.C.1

I. E. A. EXHIBITION
April 16-25th
Stand No. 610
OLYMPIA

This splendid new AVO Instrument has been developed to meet a definite demand for a sturdy pocket-size multi-range test meter at a modest price, suitable for use on modern electronic apparatus as well as for radio and television receivers, motor vehicles, and all kinds of domestic appliances and workshop equipment.

Readings are obtainable quickly and easily on a very open scale, and range selection is by means of a robust clearly marked rotary switch of the characteristic AvoMeter type. Measurements of A.C. and D.C. Voltage, D.C. Current, and Resistance are made by means of only two connection sockets.

19 Ranges

D.C. Voltage	A.C. Voltage
0 — 100mV.	0 — 10 V.
0 — 2.5 V.	0 — 25 V.
0 — 10 V.	0 — 100 V.
0 — 25 V.	0 — 250 V.
0 — 100 V.	0 — 1000 V.
0 — 250 V.	
0 — 1000 V.	

Resistance	D.C. Current
0 — 20,000Ω	0 — 100μA
0 — 2 MΩ	0 — 1mA
	0 — 10mA
	0 — 100mA
	0 — 1 A

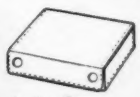
Sensitivity:
10,000 Ω/V on D.C. voltage ranges.
1,000 „ „ A.C. „ „

Accuracy:
3% of full scale value on D.C.
4% „ „ „ „ „ A.C.

To meet special requirements, instruments can be supplied to a higher degree of accuracy for a small additional charge.

List Price: **£9/10s.**
complete with Test Leads and Clips
Size: 5¾ x 3¾ x 1¾ inches
Weight: 1 lb. approx.

THE MULTIMINOR



Leather Case if required **32/6**

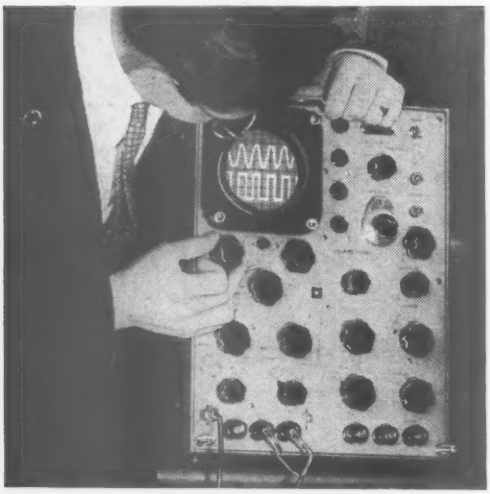
Write for fully descriptive leaflet.

Designed and Manufactured by

AVO Ltd. AVOCET HOUSE · 92-96 VAUXHALL BRIDGE ROAD · LONDON · S.W.1 *VICtoria 3404 (9 lines)*

A M.M.2.

let us demonstrate any of these superb SOLARTRON oscilloscopes



Have you seen the ***new*** Solartron Double-Beam Solarscope CD 711 being put through its paces?
Now, for the first time, you can choose a double-beam 'scope of Solartron quality, embodying all the latest design features and built to the finest standards of electronic and mechanical engineering.
Why not write or call us now for a demonstration of the Double-Beam Solarscope, or any of the eight other models listed below? Specialist instrument engineers are immediately available to assist you, whatever your problem or field of application.

	CD 711 DOUBLE BEAM
BANDWIDTH	Max. D.C.—7 Mc/s. at 100mV/cm.
SENSITIVITY	3mV/cm.—100 V/cm.
'Y' CALIBRATION	Cal. shift. Accuracy ±5%
'X' CALIBRATION	Cal. time scale. Accuracy ±5%
TIME BASE	Time scale 0.3μSec./cm.—3 Sec./cm.
'X' EXPANSION	Continuously variable ×10
SIZE & WEIGHT	16″ × 13″ × 27½″ deep. 110 lb.

	CD 715	AD 557	CD 518	CD 568	CD 513
BANDWIDTH	Max. D.C.—20 Kc/s.	Max. D.C.—1 Mc/s.	Max. D.C.—5 Mc/s.	Max. D.C.—5 Mc/s.	Max. D.C.—10 Mc/s.
SENSITIVITY	10 mV/cm.—10V/cm.	3 mV/cm.—100 V/cm.	0.25 V/cm.—5 V/cm.	0.25 V/cm.—5 V/cm.	1 mV/cm.—10 V/cm.
'Y' CALIBRATION	Special facilities	Cal. shift ±5%	Shift meter. Accuracy ±3%	Shift meter. Accuracy ±3%	Cal. sensitivity Accuracy ±10%
'X' CALIBRATION	Special facilities	Cal. time scale. Accuracy ±10%	'Cal Pips' and sine wave. Accuracy ±2%	Sine wave. Accuracy ±2%	Cal. time scale Accuracy ±10%
TIME BASE	Sweep time 10 Sec. to 0.1 Sec.	Time scale 1μSec./cm. —1 Sec./cm.	Sweep time 100m. Sec. —1μSec.	Sweep time 100m. Sec. —1μSec.	Time scale 0.1μSec./ cm.—1 Sec./cm.
'X' EXPANSION	×1, ×0.5, ×0.2, ×0.1, ×0.05	Continuously variable × 10			×0.5, ×1, ×2, ×5
SIZE & WEIGHT	14″ × 10″ × 20″ deep. 47 lb.	16½″ × 10″ × 22″ deep. 70 lb.	12″ × 9″ × 18″ deep. 40 lb.	12″ × 9″ × 18″ deep. 40 lb.	16½″ × 10″ × 22″ deep. 70 lb.

	CD 523S	CD 814	CD 643
BANDWIDTH	Max. D.C.—10 Mc/s.	Constant 1 c/s.–8 Mc/s.	Constant D.C.— 15 Mc/s.
SENSITIVITY	1 mV/cm.—10 V/cm.	30 mV/cm.—30 V/cm.	100 mV/cm.–60 V/cm.
'Y' CALIBRATION	Cal. sensitivity Accuracy ±10%	Comparison method Accuracy ±5%	Cal. shift. Accuracy ±2%
'X' CALIBRATION	Cal. time scale Accuracy ±10%	'Cal Pips' Accuracy ±5%	'Cal Pips'and brightup Accuracy ±2%
TIME BASE	Time scale 0.1μSec./ cm.—1 Sec./cm.	Repetition Rate 6 c/s—185 Kc/s.	Time scale 0.1μSec/cm. —100m. Sec./cm.
'X' EXPANSION	× 0.5, × 1, × 2, × 5	Continuously variable × 10	Continuously variable × 100
SIZE & WEIGHT	16½″ × 10″ × 23″ deep. 70 lb.	14½″ × 10½″ × 19½″ deep. 43 lb.	20″ × 14¾″ × 27¾″ deep. 140 lb.

PRICES
Home & Export (F.O.B., packing extra)

CD 711	£320
CD 715	£460
AD 557	£275
CD 518	£225
CD 568	£210
CD 513	£220
CD 523S	£265
CD 814	£115
CD 643	£490

write or 'phone now for appointment

THE SOLARTRON ELECTRONIC GROUP LIMITED

THAMES DITTON • SURREY • Telephone: EMBerbrook 5522 • Cables: Solartron, Thames Ditton

Mullard

Electronic valves, tubes & semiconductors

Instruments, Electronics and Automation Exhibition, 1958

Stand 501 Olympia 16th-25th April

Audio valves
Computer valves
Decade counting tubes
Disc-seal valves
Electrometer valves
Flying spot scanning tubes
Geiger Muller tubes
Germanium diodes
Germanium transistors
Image convertors
Instrument cathode ray tubes
Klystrons
Magnetrons
Multi-cavity klystrons
Photoconductive cells
Photo-emissive cells
Photomultiplier tubes
Phototransistors
Pulse modulator valves
Radar display tubes
Receiving valves
Rectifiers (mercury vapour)
Rectifiers (vacuum)
Rectifiers (xenon)
Reference tubes
R.F. heating valves
Scaling valves
Semiconductor devices
Silicon power rectifiers
Silicon transistors
Special quality valves
Stabiliser tubes
Subminiature valves
Television monitor tubes
Thyratrons (hydrogen)
Thyratrons (mercury vapour)
Thyratrons (xenon)
Transistors
Transmitting valves
Travelling wave tubes
Trigger tubes
Tunable magnetrons
U.H.F. valves
V. H.F. valves
X-Ray tubes
Zener diodes

Mullard

Mullard Limited, Communications & Industrial Valve Department, Mullard House, Torrington Place, W.C.1 · Tel: LANgham 6633

MVT347a

Visit Advance – to be sure!

I.E.A. EXHIBITION

STAND 608

I.E.A. EXHIBITION

OLYMPIA

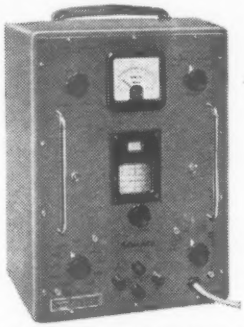
APRIL 16th - 25th

Among the many tried and proven instruments exhibited on the 'Advance' stand will be shown for the first time a new L.F. Signal Generator. Modern in circuitry, design and performance, this accurate, wide-range instrument has outstanding attenuation and source impedance facilities, making it a valuable instrument in the audio field.

See this NEW

L.F. SIGNAL GENERATOR

TYPE 81



A wide range instrument providing an output of 1 watt into 600 ohms over a frequency range of

15 c/s to 200 kc/s

Attenuation: Variable, 1 dB steps over 70 bB.
Output Impedance: 600 Ω Unbalanced, 600 Ω Balanced, 300 Ω Unbalanced

Net price **£105** in U.K.

Also

THE LATEST DEVELOPMENTS IN ELECTRONIC TEST & MEASURING INSTRUMENTS SIGNAL GENERATORS 'Q' METERS ETC.

And **VOLTAGE STABILIZATION EQUIPMENT**

From Europe's most comprehensive range of Constant Voltage Transformers covering power requirements from 4 to 6,000 watts providing reliable stabilization of your a.c. supplies. Our Technical Sales Engineer will be available to discuss any problems concerning Voltage Stabilization.

GD62 Advance COMPONENTS LIMITED · ROEBUCK ROAD · HAINAULT · ILFORD · ESSEX · TELEPHONE: HAINAULT 4444

THE VALVES FOR J BAND OPERATION

'ENGLISH ELECTRIC'

MAGNETRON TYPE M555

This is a new packaged magnetron for pulse operation in J Band with a peak input power rating of 240 kW. Particular care has been taken to produce a compact, rugged valve for air-borne applications.

THE M555 can be supplied for fixed frequencies within the range 14,000 to 16,500 Mc/s.

KLYSTRON TYPE K343

This is a low voltage reflex klystron for J Band operation with a minimum power output of 20 mW at 350 volts. The moulded base and flying leads specially commend it for high altitude operation. It has mechanical tuning covering the range 12,000 to 14,500 Mc/s.

KLYSTRON TYPE K346

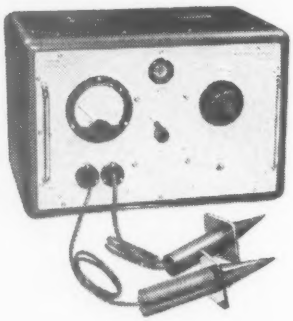
This is generally similar to type K343 with mechanical tuning from 14,500 to 17,000 Mc/s.

Both these klystrons, which may be used in conjunction with the M555 or in other J Band applications, have 30 to 80 Mc/s electronic tuning. The output connections are American type UG419/U feeding into No. 18 Waveguide.

Please visit us on Stand No. 405 at the I.E.A. Exhibition and see these and our other products

ENGLISH ELECTRIC VALVE CO. LTD. *Chelmsford, England*
Telephone: Chelmsford 3491

AP/95



BREAKDOWN TESTER MODEL RM 215E

Output Voltage: 0 to 10,000 V D.C. 5 mA. Max.
and 0 to 5,000 V A.C. 10 mA. Max.

Accurate –reliable!

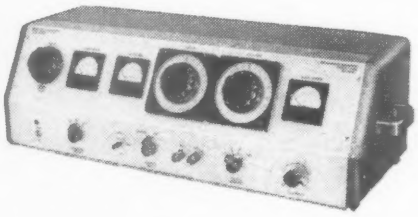
BPL

MEGOHMMETER

MODEL RM 175 — LZ MK II

Resistance Range: 0.9 Megohm to 10,000,000 Megohms.

Test Pressure: Continuously variable from 10 to 1,000 V D.C.



ELECTROLYTIC & TANTALUM

CONDENSER BRIDGE MODEL CB 154C

Capacity Range: 0.1 mFd to 11,000 mF ds.
Power Factor Range: 0.4% to 30%
Polarising Voltage: 0 to 600 Volts in 5 ranges.
Leakage Current: 0/500 uA, 0/5 mA, 0/50mA.

MODEL CB 154D

Polarising Voltage: 0 to 800 Volts in 5 ranges.
Leakage Current: 0/50 uA, 0/500 uA, 0/5 mA.
Other details as CB 154C.

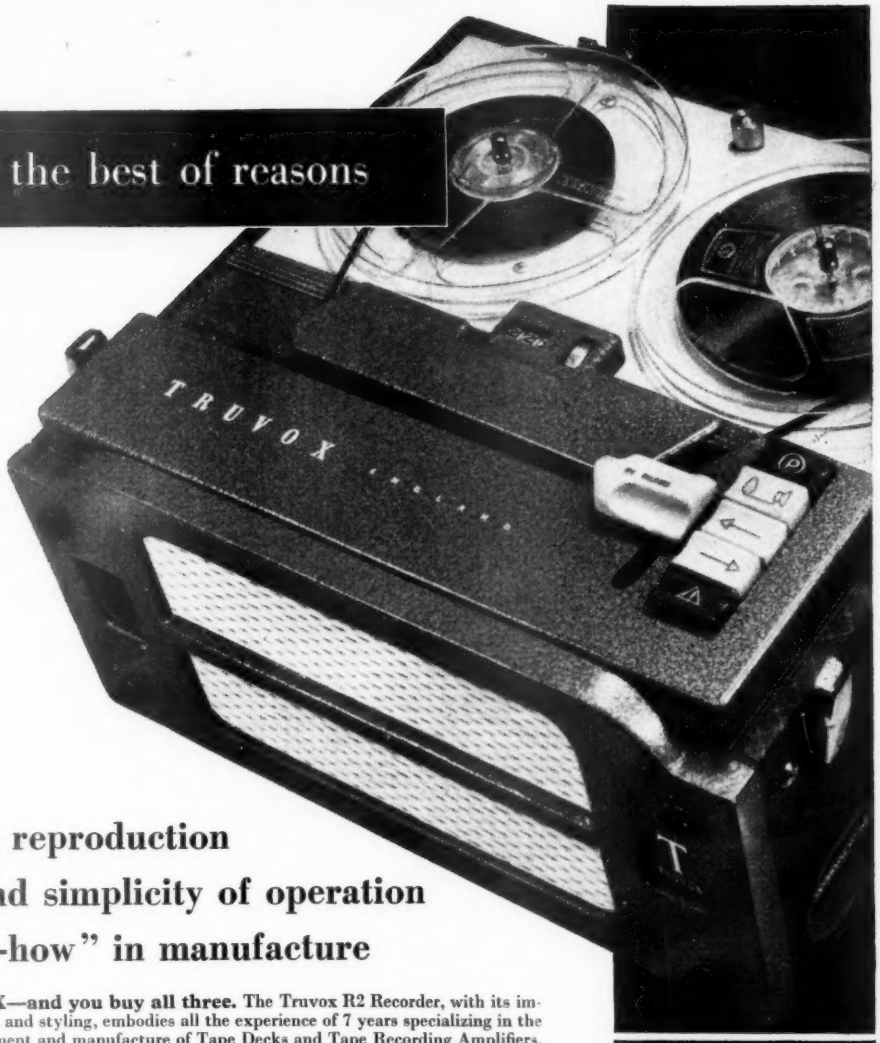
Ask for demonstration

BRITISH PHYSICAL LABORATORIES

RADLETT · HERTS
ENGLAND

TELEPHONE · RADLETT 5674

For the best of reasons



★ **Perfect reproduction**

★ **Ease and simplicity of operation**

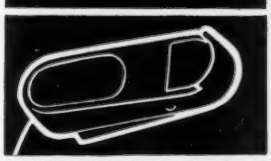
★ **"Know-how" in manufacture**

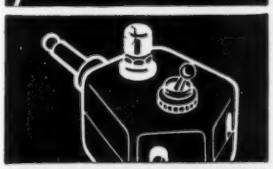
buy TRUVOX—and you buy all three. The Truvox R2 Recorder, with its improved circuitry and styling, embodies all the experience of 7 years specializing in the design, development and manufacture of Tape Decks and Tape Recording Amplifiers. There are no last minute "mods"—every stage has been tested and tested again to ensure that it lives up to the reputation enjoyed by the name it bears.

The result is a high fidelity instrument that will give you endless hours of enjoyment producing and replaying your own recordings as well as providing perfect reproduction of pre-recorded tapes with all those finer gradations of tone that are there for those who can hear the difference.

Additional applications of this machine, with accessories, include dictation and transcription, radio reception, telephone conversation recording, AM or FM Tuner amplification, etc.

When you buy TRUVOX you buy a better recorder—produced *for those who can hear the difference.*





Models from 66gns

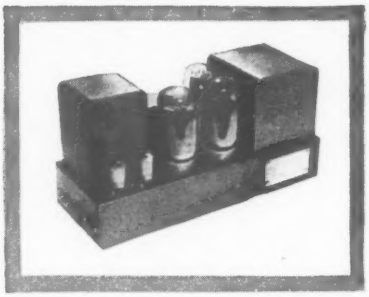
TRUVOX ***Tape Recorders***

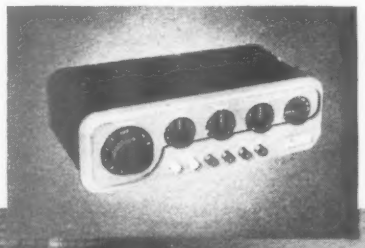
Full details, including accessories, available on request from the manufacturers :

TRUVOX LIMITED, 15 LYON ROAD, HARROW, MIDDX. **Telephone: Harrow 9282**

ACOUSTICAL

For the closest approach to the Original Sound— that your enjoyment and appreciation of music may be unimpeded





Please ask for illustrated literature describing the QUAD II Amplifier, FM Tuner and Electrostatic Loudspeaker.

ACOUSTICAL MANUFACTURING CO. LTD.
HUNTINGDON, HUNTS.
HUNTINGDON 361.

Reduce

your press tool costs

with the HUNTON

UNIVERSAL BOLSTER OUTFIT

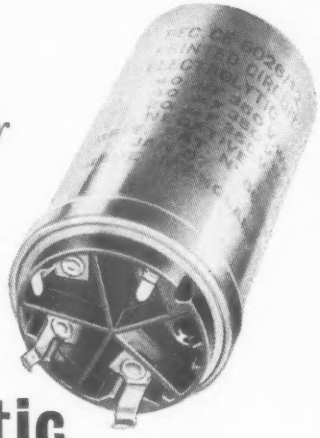
Tools for piercing and forming louvres up to 8" long.
Standard Corner Notching Tool 2½" square.
Relay Tools.
Tools for piercing apertures for Painton, Belling Lee, Plessey, etc., Plugs and sockets.
Punches and Dies for piercing valve holder holes.
Square, rectangular and slotting tools.

In addition to the range of Punches and Dies $\frac{1}{8}$" to $3\frac{3}{4}$" dia. available from stock, some of the tools usually required in the Radio and Electronic Industry have been standardised for use with the Hunton Universal Bolster Outfit. Illustrated above are a few which can be supplied quickly or from stock. In London and Home Counties, ask for a practical demonstration in your own works. Alternatively, write for illustrated price list W.W.1.

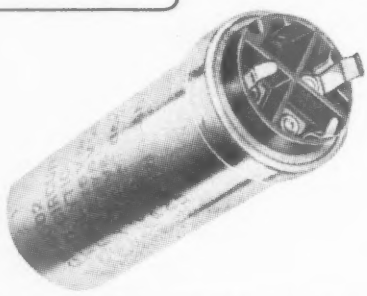
HUNTON LIMITED

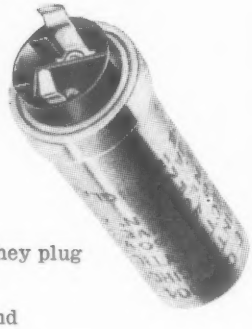
PHOENIX WORKS, 114-116, EUSTON ROAD, LONDON, N.W.1 *Telephone: EUSton 1477*

Especially designed for printed circuits...



Plessey Electrolytic Capacitors





A special range of Plessey electrolytic capacitors is now available for vertical mounting in printed circuits. They plug directly into panels and the protruding tags do not require forming or bending but simply snap into the pierced holes and force the soldering surface into direct contact with the printed copper wiring. Due to the unique design of these capacitors, it is impossible to bridge the contacts during soldering operations. Mounting is foolproof and extremely simple because of the special tag arrangement. Soldering and removal of units is easily achieved without disturbing associated components or causing inadvertent damage. Produced for either manual or automatic insertion, printed circuit capacitors by Plessey are supplied in three different can dimensions : ¾", 1" and 1¾" diameters.

Those interested in the application of these outstanding components should request a copy of Plessey Publication No. 908.

SWINDON COMPONENTS DIVISION

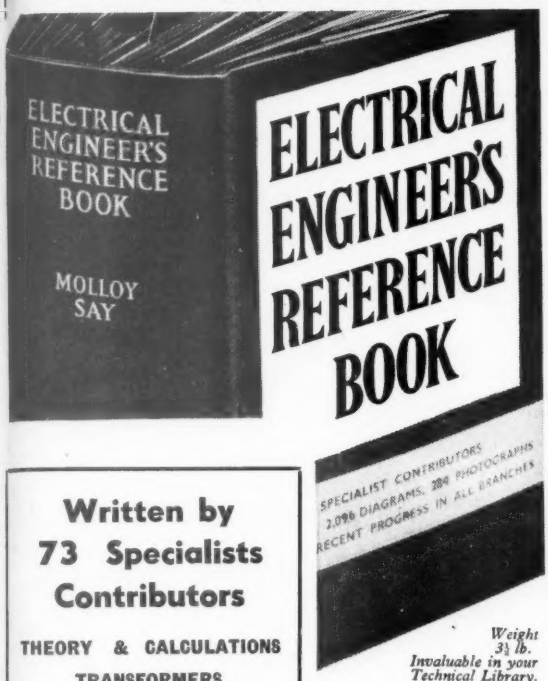
THE PLESSEY COMPANY LIMITED · KEMBREY STREET · SWINDON · WILTS · Telephone 5461

Overseas Sales Organisation: Plessey International Limited · Ilford · Essex · Telephone Ilford 3040

SC5a

NEW EDITION · 2,216 PAGES

AN INDISPENSABLE REFERENCE TO MODERN PRACTICE AND DEVELOPMENTS



Weight 3½ lb. Invaluable in your Technical Library.

Written by 73 Specialists Contributors

THEORY & CALCULATIONS
TRANSFORMERS
CABLES & WIRES
TRANSMISSION AND DISTRIBUTION
SWITCHGEAR
MOTORS & CONTROL
RECTIFIERS & CONVERTORS
WIRING AND INSTALLATION
MEASUREMENTS
POWER FACTOR CORRECTION
WELDING
BATTERIES
ELECTRONIC ENGINEERING
TRACTION, LIFTING AND CONVEYING
ELECTRICITY IN MINES AND AGRICULTURE
ELECTRICITY IN AIRCRAFT & AUTOMOBILES
EDUCATION & TRAINING
RULES, REGULATIONS AND SUPPLY DATA, ETC.

You are Invited to Examine it

Free for 7 days

WITHOUT OBLIGATION

This is the 9th edition of the most up-to-date work of its kind. Many thousands of copies of previous editions are in daily use. If you have never seen it, here is your chance—a big New Edition is now ready, and you are invited to examine it free of charge. Newnes ELECTRICAL ENGINEER'S REFERENCE BOOK is a comprehensive exposition, arranged in 33 self-contained sections, written by recognised authorities. Post Coupon Now!

ALL THESE NEW FEATURES!

Analogue and Digital Computers

World Energy Resources and Electric Power Generation including:—Fuel-fired Steam Stations ● Nuclear Reactor Stations ● Diesel-engine Stations ● Gas-turbine Stations ● Hydro-electric Plants ● Wind Generating Plant ● POWER SUPPLY NETWORKS (including recent advances in U.S.A., Western Europe and U.S.S.R.) ● TRANSISTORS ● RADIOACTIVITY

2,096 DIAGRAMS ***284 PHOTOGRAPHS***

SEND TO-DAY for FREE EXAMINATION

George Newnes Ltd., 66/69 Great Queen Street, London, W.C.99.

Send Newnes ELECTRICAL ENG. REF. BOOK without obligation to purchase. I will either return it in 8 days or send 7/6 deposit 8 days after delivery, then 8 monthly subscriptions of **10/-**, paying **87/6** in all. Cash price in 8 days is **80/-**.

Name .....

Address .....

.....

Occupation .....

Your Signature .....
(Or your Parent's Signature if under 21)

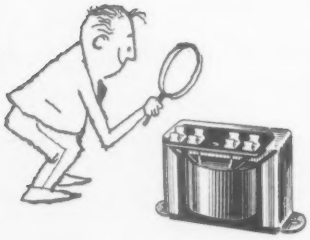
Place X where it applies.

	HouseOWNER
	Householder
	Living with Parents
	Lodging Address

EERB 2C

Tags without snags

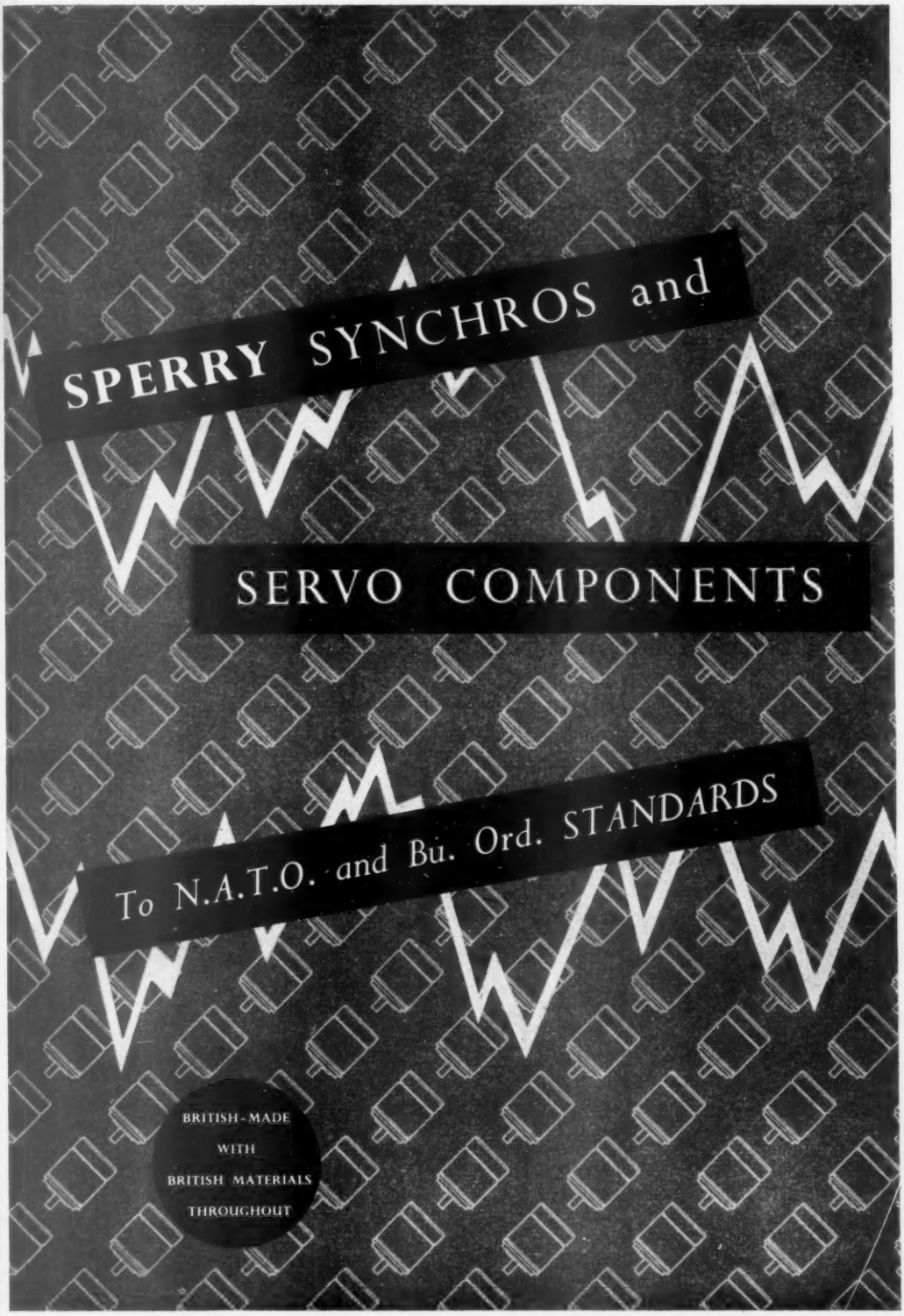
Ten years ago—in collaboration with the Tucker Eyelet Company—we designed this tag to overcome the frequent breakages experienced on normal self-eyeletting types, and evidence of its accepted excellence has been proved by its ever increasing use in the trade.
By careful attention to details such as this, coupled with specialized production techniques, rigid quality control, a design service second to none, and—vital today—cost consciousness, we have established our reputation as leading transformer manufacturers to the Electrical, Radio and Television industries. Our technical service is immediately at your call. Why not make use of it?



Take a close look at the quality of

Hinchley TRANSFORMERS

HINCHLEY ENGINEERING CO. LTD · DEVIZES · WILTSHIRE · Tel: DEVIZES 573/5



SPERRY GYROSCOPE COMPANY LIMITED, GREAT WEST ROAD, BRENTFORD, MIDDLESEX · EALing 6771

precision
and
craftsmanship

Take a look at your wristwatch. The odds are a hundred to one that in small lettering on the dial you will find the words "Swiss Made". Throughout the world Switzerland is recognised as the centre of craftsmanship in precision mechanisms. When you consider the service your watch gives you day after day —and the price you paid for it—you may well conclude that "Swiss Made" also means sheer value for money. It was by no accident that Goldring turned to Switzerland for a transcription gramophone motor. Modern record reproduction calls for a craftsman-made mechanism of more than average precision and reliability. And modern strains on purses call for nothing short of real value for money.

The Goldring-Lenco Transcription Motor is designed and made entirely in Switzerland. There are three versions (from £17. 10. 4. to £23. 7. 0. including P.T.) which incorporate the Lenco transcription arm and the Goldring "500". Your dealer will be happy to show them to you—or we will gladly send you a descriptive leaflet on request.

GOLDRING-LENCO

GRAMOPHONE TRANSCRIPTION MOTORS

Goldring Manufacturing Co. (Great Britain) Ltd.
486 High Road, Leytonstone, London, E.11
(Leytonstone 8343)

Goldring

Design Approved

X-BAND NOISE TUBE

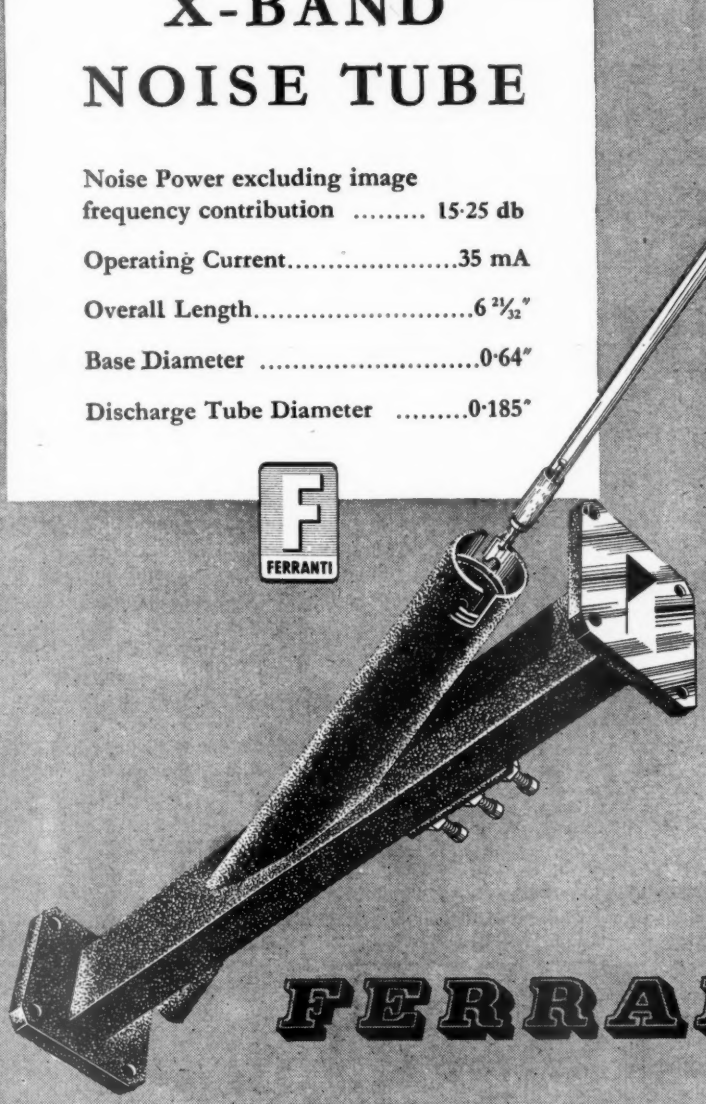
Noise Power excluding image frequency contribution ..... 15·25 db

Operating Current.....35 mA

Overall Length.....6 21/32"

Base Diameter .....0·64"

Discharge Tube Diameter .....0·185"



FERRANTI

FERRANTI LTD. · FERRY ROAD · EDINBURGH 5 Tel. Granton 89181

Visit our Stand No. M9 at the A.S.E.E. Exhibition, March 25th to 29th.

ES/T38

THE SUFLEX H.S.S. Type Polystyrene Capacitors have Joint Service Type Approval to RCS.137 40/70, H.2 and RCL.137. This is the most exacting Capacitor Specification so far published and calls for:—

Insulation Resistance
greater than $\frac{3}{4}$ million megohms.
Capacitance Stability better than $\pm$ 0·5%
Power Factor less than ·0005
After Humidity Cycling.

This performance is available in Capacitors of reasonably small dimensions.

Stand 12 R.E.C.M.F. Exhibition

H.S.S. TYPE 500v. WORKING

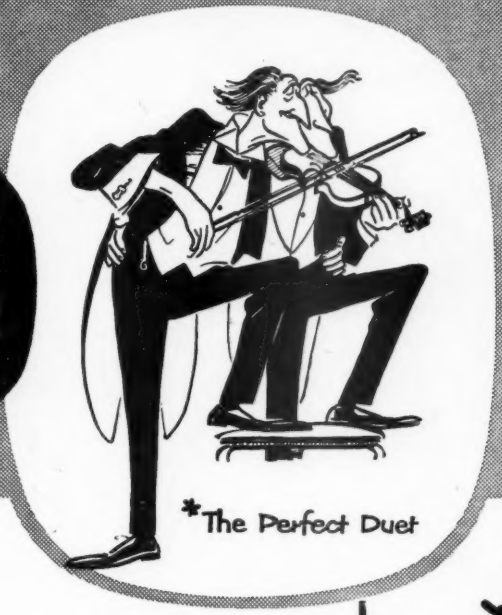
Range pf	Style	Dimensions L ins.	D ins.
10—470	CPL3A	·75 $^{+\ 0}_{-\ \cdot 15}$	·36—·23
560—2,200	CPL3B	1·0 $^{+\ 0}_{-\ \cdot 2}$	·46—·25
2,700—10,000	CPL3C	1·28 $^{+\ 0}_{-\ \cdot 12}$	·54—·41

SUFLEX *Limited*
LONDON

35 BAKER STREET, LONDON, W.1 TEL.: WEL 0791

ANTIFERENCE

VHF/FM AERIALS



*The Perfect Duet

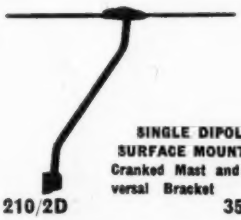
* FREQUENCY MODULATION *plus* ANTIFERENCE F/M AERIALS

Antiference specialisation in aerial design and manufacture has resulted in the finest and most comprehensive range of VHF/FM indoor and outdoor aerials in the world today.

Use an Antiference aerial—for perfect reception—wherever you may live.

SINGLE DIPOLE "GRIP ON" Universal Clamp For Masts Up to 2in. dia.

210/1A 26/6d.



SINGLE DIPOLE SURFACE MOUNTING Cranked Mast and Universal Bracket

210/2D 35/0d.

★ **ALL MODELS NOW FITTED WITH THE UNIVERSAL MAST CLAMP**

★ **Each aerial pre-assembled and complete in one carton**

★ **Fitted with anti-vibration device.**

ANTIFERENCE LIMITED

★ **Weatherproof junction units**

★ **All Antiference aerials incorporate features which are fully patented or are the subject of patents applied for.**

DIPOLE AND REFLECTOR CHIMNEY MOUNTING 6ft. × 1in. Mast and Lashing

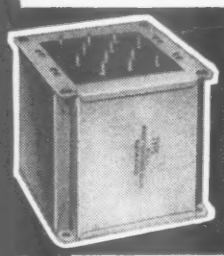
220/4E 75/0d.

Antiference Limited, Aylesbury, Bucks. Telephone: Aylesbury 2511 (6 lines)

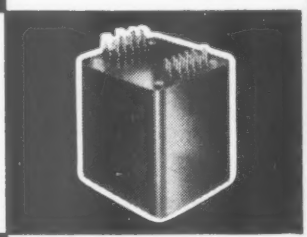
more and more users

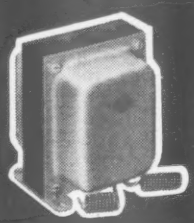
are specifying WODEN TRANSFORMER CO. LTD

TRANSFORMERS



Left: Potted Compound Filled Transformers. A wide range of capacities for transformers and chokes. Complete reliability. Suitable for exacting industrial and climatic conditions.





Above: Cast Resin Transformers. Give complete mechanical and climatic protection for core and windings. Good heat dissipation.

Bottom Left: Shrouded and Open-Type Transformers. Combine first-class engineering with a popular highly competitive product. Vacuum impregnated and rigidly tested.

WODEN TRANSFORMER CO. LTD

Catalogues available on request.

WODEN TRANSFORMER CO. LTD

MORLEY ROAD
BILSTON · STAFFS
Phone: BILSTON 41959

SM/W 2913

Everybody wants EMITAPE -you'll sell more this year!

EMITAPE "88" *General Purposes.*

EMITAPE "99" *Long play, giving 50% increased playing time.*

* 4 SPOOL SIZES

to fit all standard magnetic tape recorders

3" MESSAGE — 5" JUNIOR

5¾" CONTINENTAL — 7" STANDARD

* HIGHEST TECHNICAL STANDARDS

- High sensitivity
- Low noise level
- Low print-through factor
- Freedom from curl and stretch
- Anti-static
- Low head wear

* EMICASE

solves storage problems

protects spools from dust

allows easy identification of leader tapes

TYPE No.	TITLE	SIZE	LENGTH APPROX.	EMITAPE IN "EMICASE"	PRICE WITHOUT "EMICASE"
88/6E	"Junior"	5" dia	600'	£1 . 3 . 6	£1 . 1 . 0
★99/9E	"	5" dia.	850'	£1 . 10 . 6	£1 . 8 . 0
88/9E	"Continental"	5¾" dia	850'	£1 . 10 . 6	£1 . 8 . 0
★99/12E	"	5¾" dia	1200'	£1 . 17 . 6	£1 . 15 . 0
88/12E	"Standard"	7" dia	1200'	£1 . 17 . 6	£1 . 15 . 0
★99/18E	"	7" dia	1800'	£2 . 12 . 6	£2 . 10 . 0

★ *LONG PLAY—50% increased playing time.*

EMITAPE *the magnetic recording tape with the world-wide reputation!*

E·M·I SALES & SERVICE LTD (*Recording Materials Division*) **HAYES · MIDDLESEX**

ES159

S·S·White
REMOTE CONTROL
FLEXIBLE SHAFTING

ELIMINATE costly gears and tooling with flexible shafting! Overcome the difficulties of transmission when the point of control is not directly in line with the point of application. Controls so operated are wonderfully smooth, sensitive and positive.

If you have a problem of control consult our experts—they are there to help you!

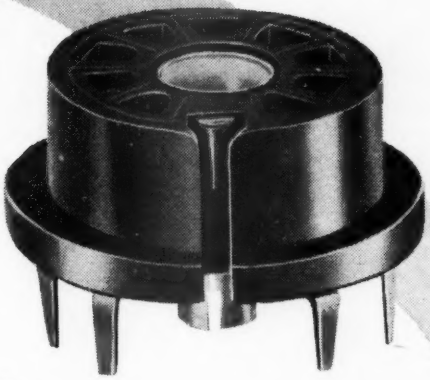
● *An invaluable reference book on flexible shafting is available to the technician on request to Dept. W.*

S·S·White
THE S·S·WHITE CO. OF GREAT BRITAIN LTD.
INDUSTRIAL DIVISION
BRITANNIA WORKS, 25-31 ST. PANCRAS WAY, LONDON, N.W.1
Telephone: EUSton 5393

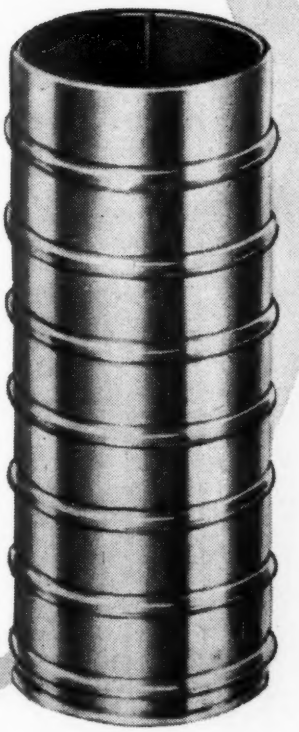
R.C.7

CINCH completes the Circuit ...

... with Valveholders, Cans and Earthing Straps of tested design and proved reliability for Printed Circuit use.



- Proved reliable tulip shape contacts.
- Mouldings support contact tails so they are readily flattened on copper foil for reliable soldered joints.
- Snap in centre screens to retain valveholders prior to dip soldering.
- Valveholders "stack" so no risk of slow assembly from bent contact tails.
- C.F.W. finish, exclusive to Cinch, developed specially for dip soldering.
- Separate snap in earthing straps for screening cans—fit them where required on standard valveholders.



* Similar B7G Valveholders and Cans are also available, together with other valveholders for Printed Circuits and Printed Circuit components.

CARR FASTENER COMPANY LIMITED · STAPLEFORD · NOTTINGHAM

Sole Selling Representatives: THE BENJAMIN ELECTRIC LIMITED · TOTTENHAM · N.17

Tel.: TOTtenham 9721
Smee's 122

Introducing the Dual-throated Port principle

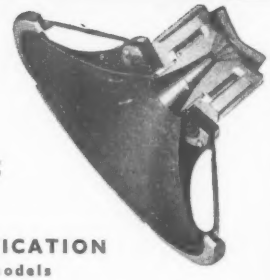
TANNOY

HIGH FIDELITY DOMESTIC LOUDSPEAKERS

TANNOY PRODUCTS LIMITED. *Practitioners in Sound*
West Norwood · London · S·E·27 · Gipsy Hill 1131

The loudspeaker enclosures in this new range are designed to take full advantage of the outstanding performance of Tannoy Dual Concentric Loudspeaker Units. For the first time the dual-throated port principle is employed, marking a notable advance on the more orthodox type of reflex cabinet. Both corner and side wall models make optimum use of the additional acoustic loading offered by walls and floor. Styling is modern but restrained and a wide range of carefully chosen veneers is available to blend with any furnishing scheme. Cabinets are hand-polished and fitted with tygan plastic fabric coverings—acoustically superior to cloth or metal, and easily cleaned with a damp sponge.

THE DUAL CONCENTRIC

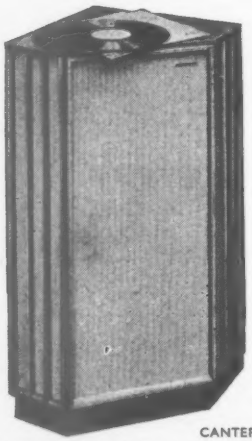


BASIC SPECIFICATION
12" and 15" models

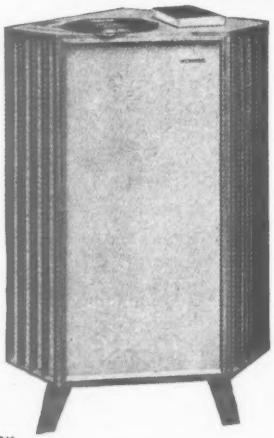
Frequency response
30-20,000 *c.p.* ± 3*dB.*

Polar Distribution for
60° *inc. angle-4dB. at*
10,000 *c.p.s.*

Intermodulation Products
less than 2%



CANTERBURY
Height 3'-1", width 2'-1", front to rear corner 1'-5"



YORK
Height 3'-9½", width 2'-8", front to rear corner 1'-10½"

ELECTRO METHODS LTD OF STEVENAGE

BRITAIN'S FOREMOST DESIGNERS

AND MANUFACTURERS OF

HIGH STABILITY MAGNETIC AMPLIFIERS

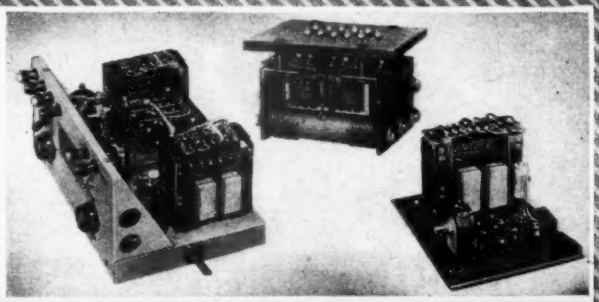
An extensive range
of our standard types of
SINGLE-STAGE or PUSH-PULL
Magnetic Amplifiers
is always available for
prompt delivery

*

SPECIAL TYPES CAN BE DESIGNED
TO SUIT YOUR NEEDS

*

Full technical data
and illustrated leaflets promptly
forwarded on request



ELECTRO METHODS LTD. 12-36 CAXTON WAY, STEVENAGE, HERTS. Phone: STEVENAGE 780

It is gratifying to know that in a world of rising prices our policy of maintaining and, in many instances, reducing prices has resulted over the years, and especially at this period, in ever increasing sales.

We carry a stock of 2,000 types of receiving, transmitting and special purpose tubes, and invite your enquiries not only for commercial grade tubes but also for those tested to C.V., JAN and MIL specifications.

Our Organisation is A.R.B. Approved.

If you are not already on our Mailing List, please send for latest Price and Stock Lists.

HALL ELECTRIC LTD

Haltron House, 49/55 Lisson Grove, London, N.W.1

Telephone:
AMBassador 1041 (5 lines)
Cables:
Hallectric, London
TELEX 2-2573

NOW
New Orthophonic High Fidelity
FROM VHF/FM

The RCA FM Tuner incorporates many new refinements, enables you to realise the great advances made in broadcasting bringing into your home a thrilling, living realism.

★ **Precision Tuning**
The new RCA Electron Ray Tuning Indicator makes exact tuning simplicity itself.

★ **No interference**
The FM system coupled with RCA circuitry results in exceptional signal-to-noise ratio.

★ **Extended Tuning Range**
87.5-108 *Mc/s covers the entire international FM broadcasting band.*

★ **Great Sensitivity**
2 *microvolts for* 20 *db quietening—extends the 'fringe'* 7 *valves plus* 2 *crystal diodes and Electron Ray tuning indicator.*

★ **High Fidelity**
Wide range response within 1 *db from* 20-15,000 *c/s for true High Fidelity reproduction.*

★ **No Matching Problems**
Adjustable output levels.

★ **Automatic Frequency Control**
Ensures complete freedom from drift.

★ **Power Requirements**
230-390 *volts D.C. at* 40 *milliamps H.T. supply.* 6.3 *volts,* 2.25 *amps heater supply (available from RCA New Orthophonic High Fidelity power amplifier).*

£24 . 3 . 0 plus **£9 . 8 . 4** P.T.

RCA

RCA GREAT BRITAIN LTD.
(An associate Company o Radio-Corporation of America)
Lincoln Way, Sunbury-on-Thames, Middx.
Tel.: Sunbury-on-Thames 3101

WIDE RANGE CAPACITANCE BRIDGE

Designed for the accurate measurement of capacitance and resistance in the range 0·002pF to 100μF and 1Ω to 10,000MΩ respectively.

All measurements are made in the form of a three terminal network and components can be measured in situ. Accuracy within ± 1% Frequency 1592 c/s (ω=10,000).

Full technical information on this and other 'Cintel' Bridges is available on request.

CINEMA TELEVISION LTD

A COMPANY WITHIN THE RANK ORGANISATION LIMITED

WORSLEY BRIDGE ROAD · LONDON · S.E.26
HITHER GREEN 4600

SALES AND SERVICING AGENTS:
Hawnt & Co. Ltd., 59 Moore St., Birmingham, 4
Atkins, Robertson & Whiteford Ltd., Industrial Estate, Thornliebank, Glasgow
McKellen Automation Ltd., 122 Seymour Grove, Old Trafford, Manchester 16

New addition to the Thorn family of miniature indicator lampholders designed to use the Atlas midget panel lamp which is only 0.575" in length and 0.249" in diameter

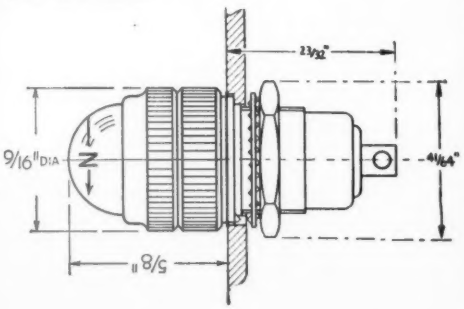
INTRODUCING THE **Thorn**

ROTARY SHUTTER

LAMPHOLDER

SHORT AND LONG SHANK VERSIONS

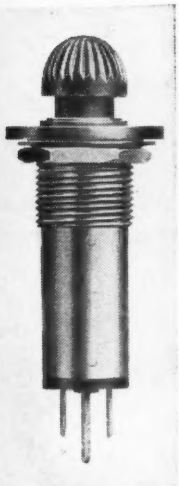
This lampholder represents an outstanding advance in space-saving—the outside diameter of the complete device is only $\frac{9}{16}$". Here, then, is the smallest of all dimmer indicator lamps. The cap contains a rotary shutter with built-in stops to restrict rotation between the fully-shuttered and the fully-open positions. When fully shuttered there is sufficient illumination for night vision. Glass lenses are engraved with the direction of rotation and letters indicating night and day conditions. The short shank version is designed for panel fitting where there is no "Plasteck" panel intervening between the indicator cap, and the lampholder. The long shank version is for use where a "Plasteck" panel intervenes and/or where the extended length may be necessary to suit special installations. Both components are designed to screw into the standard lampholder body used for Plasteck lighting L/H body 80/10/0063 earth return. This can be supplied as double pole version if required. Colour of cap: red, green, amber, blue or clear. Can be supplied with 28V, 12V or 6V bulb.



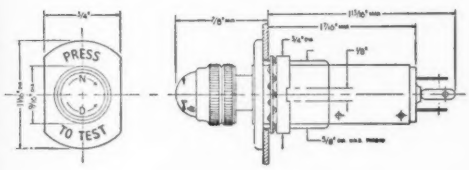
AND THE MINIATURE

PRESS-TO-TEST

FITTING



Extreme compactness has been achieved in this new "Press to Test" component. For installation a round hole $\frac{11}{64}$" diameter is all that is necessary in the mounting panel. The component can be extracted from either the front or from the back of the panel. There are two versions one with 3 terminals (solder or screw 1 terminal common) and the other with 5 tag terminations, solder (1 terminal common). The internal contact assembly are so arranged as to be free from normal aircraft vibration conditions and pre-determined contact pressures are maintained in the design technique. The front indicator plate can be engraved "Press to Test" or for any other engraving to suit operational requirements. The lampholder cap may be either the indicator or rotary shutter type. Colour of cap: red, green, amber, blue or clear. Can be supplied with 28V, 12V or 6V bulb.

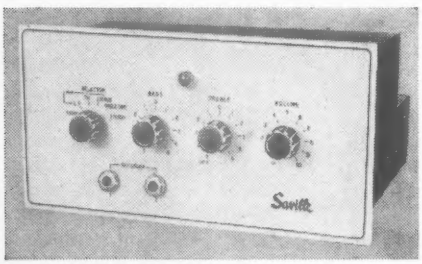


For full information write:

AIRCRAFT COMPONENTS DIVISION
THORN ELECTRICAL INDUSTRIES LTD
GREAT CAMBRIDGE ROAD, ENFIELD
MIDDLESEX. TEL: ENFIELD 5353

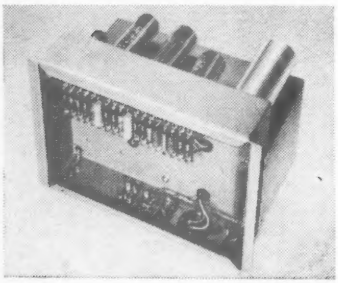
This is the amplifier that will not date

'Saville' is the amplifier of the future. It has been designed in the light of the very latest developments for the reproduction of sound in the home, including the revolutionary new stereo discs— 3-dimensional sound. Produced by the makers of ***Period High Fidelity,*** *'Saville' inherits all the technical excellence and superlative craftsmanship for which the company is renowned. 'Saville' offers the high fidelity enthusiast a top-quality amplifier with provision for twin-channel tape and disc reproduction plus the ultimate in new recording techniques.*



SAVILLE PRE-AMPLIFIER

Construction and wiring are to the highest instrument standards and all components are very conservatively rated. **PRICE £15.0.0**



SAVILLE MAIN AMPLIFIER

Output transformer is of the distributed load "C" core type, and there is ample H.T. and L.T. for auxiliary equipment. **PRICE £27.0.0.**

ADVANCE FEATURES

PRE-AMPLIFIER

- ★ 6-position control: radio, tape (direct from deck), gram 78, gram L.P, stereo records, stereo tape.
- ★ Equalisation: tape to C.C.I.R. characteristics; gram to R.I.A.A. characteristics; stereo position fully equalised.
- ★ Treble cut and boost:— 20 db to +14 db.
- ★ Bass cut and boost:— 20 db to +20 db.
- ★ Inputs at rear of chassis: radio, tape, gram, stereo tape, stereo gram.
- ★ On front panel, sockets for monaural tape recorder and Ferrograph 77 and 88 stereo recorder.
- ★ Two entirely separate channels are provided, matched to within 1 db, all the controls being matched and ganged on the two channels.

MAINS AMPLIFIER

- ★ Output: 20 watts rated. 30-35 watts peak.
- ★ Power response: at 20 watts — 32 c/s to 30,000 c/s ±1 db
- ★ Distortion measured at 1,000 c/s and 20 watts: <0.1%
- ★ Hum and noise: 85 db down at rated output.

Post this coupon today to

PERIOD HIGH FIDELITY Ltd.,
28 SOUTH ST., MAYFAIR, LONDON, W.1
Tel.: GROsvenor 4686

for full details of the 'Saville' amplifier.

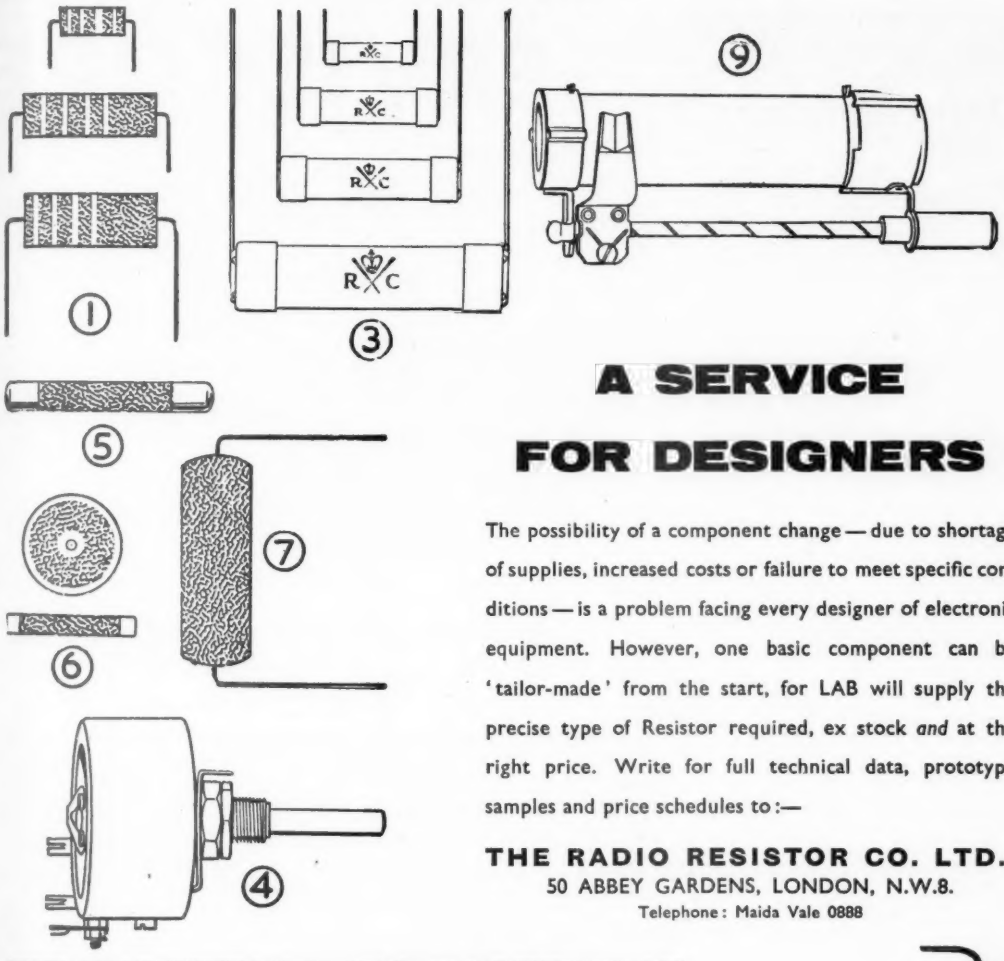
Name.....

Address.....

.....

WW1

Period High Fidelity
LIMITED
28 SOUTH STREET MAYFAIR, W.1. Tel.: GRO 4686



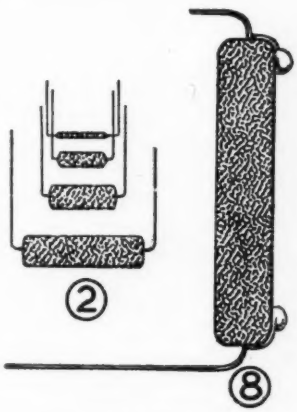
A SERVICE FOR DESIGNERS

The possibility of a component change — due to shortage of supplies, increased costs or failure to meet specific conditions — is a problem facing every designer of electronic equipment. However, one basic component can be 'tailor-made' from the start, for LAB will supply the precise type of Resistor required, ex stock *and* at the right price. Write for full technical data, prototype samples and price schedules to:—

THE RADIO RESISTOR CO. LTD.,
50 ABBEY GARDENS, LONDON, N.W.8.
Telephone: Maida Vale 0888

CARBON	WATTS	OHMIC RANGE	TOLERANCES ±
1. Solid	½ 1 & 2	10—10M	5% & 10%
2. Cracked	1/30—20	1—500M	5% & 10%
3. * High Stability	1/10—3	1—50M	0.5% 1% 2% 5%
4. Variable	½	5K—2M	—
5. V. High Resistance	½—3	50M—10^{13}	5% & 10%
6. V.H.F. (Rods & Discs)	1/10—1	10—1K	1% & 2%
WIREWOUND			
4. Rheostats	4—500	10—80K	—
9. Sliders	3—15	10—16K	—
8. Vitreous	3—500	1—150K	1% 2% 5%
7. Cemented	1—15	1—25K	5% & 10%

* The ubiquitous blue (1%) grey (2%) "HISTABS"



Do you KNOW

THAT the sub-miniature 1/30th watt unit (2) is probably the smallest production Resistor made.

THAT almost non-inductive Resistors in cracked carbon are available up to 20 watts rating.

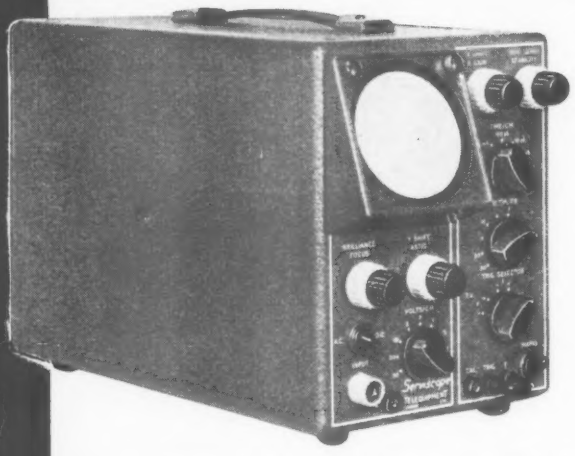
25 YEARS LAB RESISTOR JUBILEE YEAR OF RESISTOR SPECIALISATION

THE SERVISCOPE

REGD TRADE MARK

DC TO 6 Mc/s

TIME AND VOLTAGE CALIBRATION



A PORTABLE HIGH PERFORMANCE MEASURING OSCILLOSCOPE

★ INCORPORATES AN ENTIRELY NEW TYPE OF TIME BASE
formerly only available on the most expensive American oscilloscopes.

★ 18 PRE-SET CALIBRATED SWEEP SPEEDS FROM
.5 sec/cm to 1 μ sec/cm

★ AUTOMATIC TRIGGERING OR TRIGGER LEVEL SELECTION

★ DC COUPLED UNBLANKING

★ 9 CALIBRATED Y SENSITIVITIES
FROM 100 mV/cm to 50V/cm ALL DC TO 6 Mc/s

★ SWEEP EXPANSION TO OVER 10 SCREEN DIAMETERS

★ BUILT-IN TV SYNC SEPARATOR

★ ULTRA BRIGHT 3″ FLAT FACE CRT

★ COMPLETELY PORTABLE 8″ x 6″ x 12″

THE FINEST, MOST VERSATILE

portable oscilloscope ever offered to the electronics industry.

Write for fully illustrated leaflet.

TELEQUIPMENT LTD

313 Chase Road, Southgate, London N.14. PALmers Green 7111

A Switch Idea —that's near perfection

Introduced to Britain by Plessey, the unique principle of 'Wedgelock' fixed contacts in switch construction has gained nation-wide acceptance, and an ever-increasing number of manufacturers are now specifying Plessey 'Wedgelock' Switches for many applications. Contacts are '*Wedgelocked*' into the stators which are securely held to guarantee positive location in all switching positions. Continuous contact efficiency is assured because even excessive tangential pressure will not distort the contact clips.

Design Engineers who have not yet received a copy of the new, comprehensive Plessey Switches Catalogue are invited to send for Publication No. 922.

PLUS POINTS of G.A.1. Switches are:

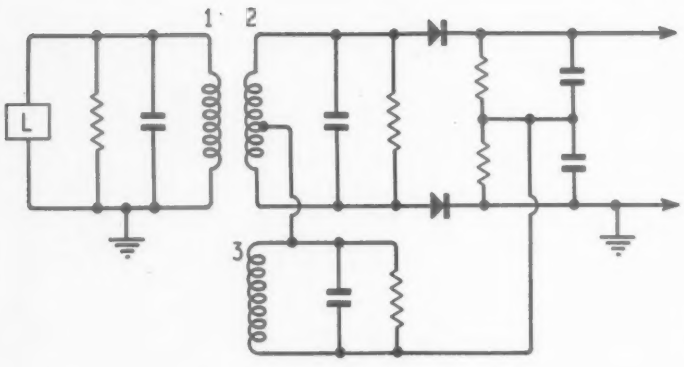
- ✳ **Double-wiping, self-cleaning contacts**
- ✳ **Accommodation for up to 22 insulated contacts per wafer**
- ✳ **Up to 12 positive positions can be utilised —30° indexing (a special 60° index plate can be supplied if required)**
- ✳ **Provision for unusual circuit arrangements**
- ✳ **Single- or multi-wafer construction**
- ✳ **Variable overall dimensions**
- ✳ **Provision for electrostatic screening by metal shields between adjacent banks**

Plessey

COMPONENTS GROUP • SWITCH UNIT
THE PLESSEY COMPANY LIMITED · NEW LANE · HAVANT · HANTS · Tel: HAVANT 1311
Overseas Sales Organisation: PLESSEY INTERNATIONAL LIMITED · ILFORD · ESSEX · *Telephone:* ILFORD 3040

CO1

Combined Limiter and Discriminator



In this article in the March issue of ELECTRONIC & RADIO ENGINEER there is described a new form of combined limiter and discriminator for f.m. receivers. A modified Foster-Seeley discriminator is used in conjunction with a diode limiter. This limiter includes a resonant circuit tuned to the third harmonic of the carrier frequency. This profoundly modifies the action of the diode and enables 50 dB of a.m. suppression to be obtained.

Original articles by leading authorities are a prominent feature of ELECTRONIC & RADIO ENGINEER. *Regular readership will keep you in constant touch with progress in the entire field of electronics, radio and television.*

ARTICLES IN THE APRIL ISSUE WILL INCLUDE . . .

Subjective Sharpness of Television Pictures
This article describes some experiments in which television pictures were deliberately degraded. It was found that combined frequency and phase distortion is much more objectionable than frequency distortion alone. The information obtained is of use in specifying the performance required of lenses in television cameras.

Parallel-T RC Selective Amplifier
A variation on the usual circuit is analysed. The signal is injected at the null point of the network from a low-impedance source. Precise calculation of performance is possible.

ALSO
The unique monthly Abstracts and References feature compiled by the Radio Research Organization of the Department of Scientific and Industrial Research.

POST THIS COUPON TODAY

ELECTRONIC & RADIO ENGINEER

TO: ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Please enter my name as a subscriber to:—
ELECTRONIC & RADIO ENGINEER *for 12 months commencing with the April issue. I enclose remittance £2 9s. (U.S.A. and Canada $7.50).*

ORDERS CAN ALSO BE PLACED THROUGH ANY NEWSAGENT

NAME .....

ADDRESS .....

.....

DATE .....

THE VALVES FOR J BAND OPERATION

'ENGLISH ELECTRIC'

MAGNETRON TYPE M555

This is a new packaged magnetron for pulse operation in J Band with a peak input power rating of 850 kW. Particular care has been taken to produce a compact, rugged valve for air-borne applications.

TYPE M555 can be supplied for fixed frequencies within the range 14,000 to 16,500 Mc/s.

KLYSTRON TYPE K343

This is a low voltage reflex klystron for J band operation with a minimum power output of 10 mW at 350 volts. The moulded base and flying leads specially commend it for high altitude operation. It has mechanical tuning covering the range 15,000 to 16,000 Mc/s.

KLYSTRON TYPE K340

This is generally similar to type K343 with mechanical tuning from 16,500 to 17,500 Mc/s.

Both these klystrons, which may be used in conjunction with the M555 or in other J band applications, have 30 to 80 Mc/s electronic tuning. The output connections are American type UG-419/U feeding into No. 18 Waveguide.

ENGLISH ELECTRIC VALVE CO. LTD. *Chelmsford, England*
Telephone: Chelmsford 3491

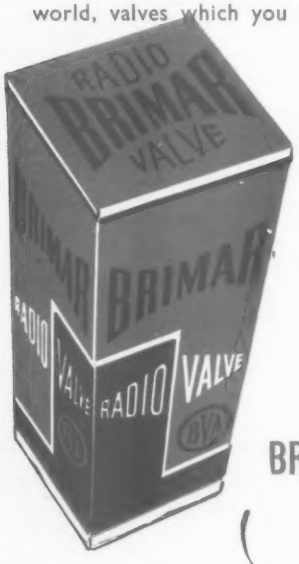
B

Overseas buyers!

pay STERLING for your American Type Valves

More and more the world's governments . . . set makers . . . laboratories are standardizing on American types, valves which are obtainable anywhere in the world, valves which you can get from BRIMAR without expending dollars.

BRIMAR valves are readily available everywhere, and with their craftsmanship, precision of manufacture, are amongst the finest obtainable.



Efficient . . . reliable . . . robust . . . BRIMAR VALVES are chosen for radio and electronic equipments in the fighting services and throughout industry. Their rugged dependability can contribute so much to your own products.

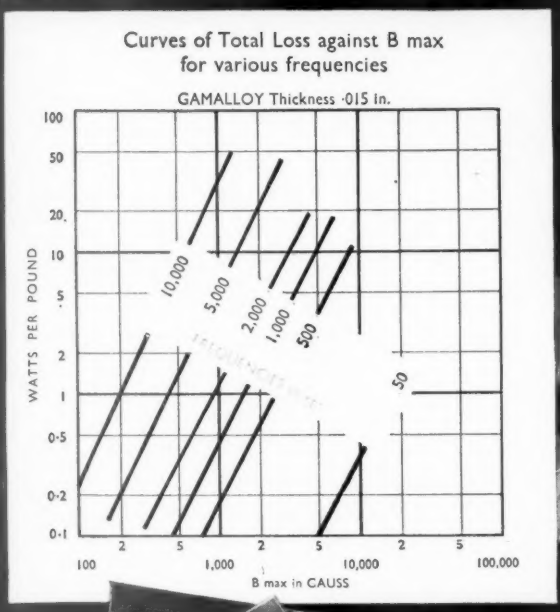
BRIMAR everywhere

The Valve of Value

Dependable

BRIMAR RADIO VALVES

Standard Telephones and Cables Limited FOOTSCRAY, SIDCUP, KENT, ENGLAND.



GAMALLOY: nickel-iron core material

'GAMALLOY 48' is the newest nickel-iron core material to be added to the wide range of R.T.B. magnetic materials. As the inset curves indicate, GAMALLOY has low total losses throughout the audio frequency range and, moreover, its permeability at flux densities up to 14,000 gauss is very good. In every way GAMALLOY is an ideal core material for use in small transformers and chokes required in the telecommunications and electronics industry.

GAMALLOY is manufactured as hot-rolled sheets in widths up to 18 inches, and in two standard thicknesses—·015" and ·005"

Full technical data can be found in our new catalogue.

RICHARD THOMAS & BALDWINS LTD.

LAMINATION WORKS: COOKLEY WORKS, BRIERLEY HILL, STAFFS.
MIDLAND SECTION OFFICE: WILDEN, STOURPORT-ON-SEVERN, WORCS.
HEAD OFFICE: 47 PARK STREET, LONDON, W.1

Our Cookley Works is one of the largest in Europe specializing in the manufacture of laminations for the electrical industry.

NOT 100101 010110 110211

BUT 100101 010110 111011

Because

YOU CAN COUNT ON

HIVAC

COLD CATHODE TUBES

In addition to cold cathode diodes and triodes for decimal or binary counting, storing, gating, switching, etc., HIVAC products include indirectly and directly heated subminiature valves, neon indicator lamps, specialised filamentary indicator lamps, telephone switchboard lamps and transistors.

HIVAC
THE SCIENTIFIC VALVE

Hivac Limited

A member of the Automatic Telephone and Electric Group

STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX
ENGLAND

Phone: Ruislip 3366 *Cables: Hivac, Ruislip*

XUM

What's New

IN TELEVISION? RADIO?
HI-FI? RECORDS?

you'll find all the answers at
THE BRITISH NATIONAL

RADIO SHOW

EARLS COURT
LONDON

August 26 — September 6 1958

Organised by
THE RADIO INDUSTRY COUNCIL
59 RUSSELL SQUARE,
LONDON, W.C.1, ENGLAND
Telegrams: OIDARION WESTCENT LONDON.

INTRODUCING THE NEW

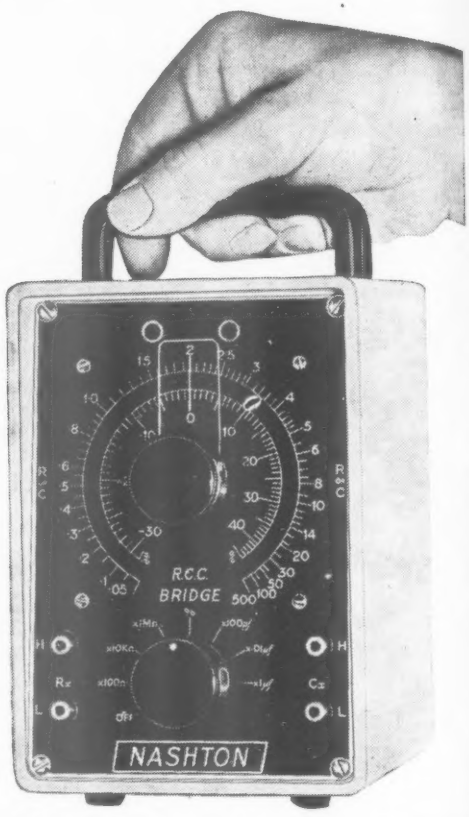
NASHTON INSTRUMENT RANGE

Resistance
(5Ω to 500MΩ)

Capacitance
(5pF to 500μF)

Comparison
(−30% to+45%)

BRIDGE



The Nashton R.C.C. Bridge is the first of a new range of electrical test instruments by Nash & Thompson, the Company specially selected to carry out the R.C.S.C. approval testing for the Ministry of Supply. The R.C.C. Bridge is precision-built of high stability 1% components and incorporates a 0.1% linearity wire-wound cam-corrected balancing potentiometer.

Instruments in the new Nashton range, of which the R.C.C. Bridge is the first, will all be

Accurate • Low-priced • Reliable
Compact

WRITE TO:—

Nash and Thompson

LIMITED

OAKCROFT ROAD • CHESSINGTON • SURREY • *Elmbridge 5252*

for inclusion in the NASHTON mailing list for information

WHG/NT52

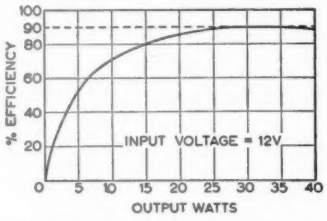
ELLIOTT

Transistor POWER PACK

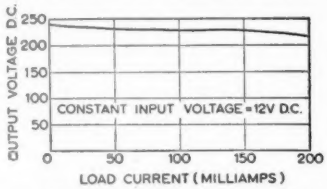
This new, complete power supply unit, for the operation of all types of electronic equipment, maintains its extremely high output efficiency for a considerably longer useful life than that of the rotary converters and vibrator packs it has been designed to replace. Battery consumption, in mobile use, is reduced to a minimum. In all applications the Elliott Transistor Power Pack enables electronic equipment to be operated more economically.

TYPE ETP/1

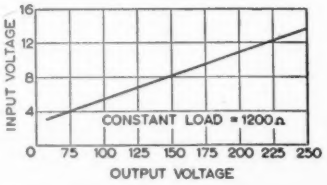
EFFICIENCY AT VARYING LOADS



OUTPUT VOLTAGE WITH VARYING LOAD CURRENT



OUTPUT VOLTAGE AT VARYING INPUT VOLTAGE



★ **Simple in design, resistant to vibration and shock. No fire risk.**

★ **No maintenance or adjustment required.**

★ **Output efficiency not less than 87% on normal applications. Output efficiency with special radiation filter unit 80% to 83%.**

★ **Not less than 85% full load efficiency over temperature range −20°C to +50°C.**

★ **Operates either on 6, 12 or 24 V d.c. supply. Output 200 to 250 V d.c. at 12 to 100 W.**

APPLICATIONS INCLUDE:

VHF AND UHF MOBILE RADIO-TELEPHONE SYSTEMS • CAR RADIOS • AIRCRAFT HF, VHF AND UHF INTER-COMMUNICATION SYSTEMS • TELEPHONE MULTI-CHANNEL CARRIER SYSTEMS • AIRCRAFT RADIO-COMPASS EQUIPMENT • COMMUNICATION RECEIVERS • LIGHTING SYSTEMS FOR CABIN CRUISERS, ETC.

Send for full details to: **RADIO AND RADAR DIVISION, ELLIOTT BROTHERS (LONDON) LIMITED AIRPORT WORKS, ROCHESTER, KENT. (CHATHAM 44400)** *A Member of the Elliott-Automation Group*

INDUSTRIAL

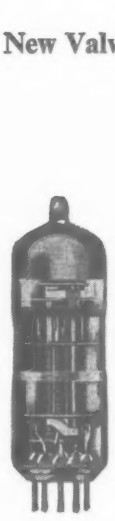
20,000 times more sensitive than an ordinary photocell

A new type of photocell with an entirely new order of performance has been developed in the Mullard Solid State Physics Laboratories and is now about to go into production.

Employing a large area cadmium sulphide photosensitive element, the new cell provides a sensitivity approaching that of a photo-multiplier . . . . *and* a current handling capacity of tens of milliamps.

Technical information is in the course of preparation and you are invited to use the coupon at the foot of the opposite page.

New Valve for 470 Mc/s Equipment

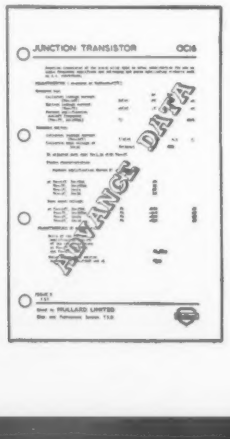


The six watt double tetrode QQV02–6 is designed for low cost 470 Mc/s mobile equipment. This compact valve features a frame grid and the same unique twin construction as other Mullard double tetrodes—a construction which provides higher efficiencies, high power gain and heater economy. Write for details of the QQV02–6 and other Mullard double tetrodes.

Transistor OC16 now available in quantity

Transistor OC16 is now available in quantity. This high output germanium junction transistor is being used to great advantage in audio frequency amplifiers and switching and pulse oscillating circuits such as d.c. converters.

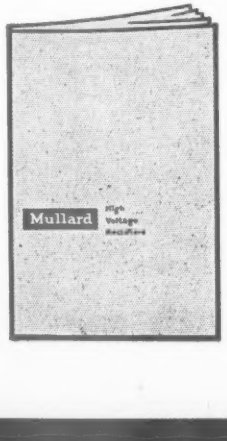
A pair of OC16's operating in Class B push-pull will provide an output in excess of 10 watts into loudspeakers with 12 volts "H.T.". Thirteen pages of data are available on the OC16. Please write or send coupon to the address at the foot of the opposite page.



Three New High Voltage Rectifiers

Recent developments in the Mullard 1.25 amp range of xenon rectifiers have led to improved hold-off characteristics and higher reliability. These improvements, together with the already widely recognised advantages of xenon rectifiers, strongly recommend these valves for power supplies in transmitters, r.f. heaters and similar equipment.

Full details of these three rectifiers, the RR3–1250, the RR3–1250A and RR3–1250B, together with information on other xenon and mercury vapour rectifiers are given in the free data booklet "High Voltage Rectifiers" offered in the accompanying coupon.

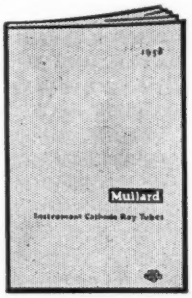


Mullard

VALVE NEWS

Six C.R.T.'s that cover most instrument applications

Designers faced with the problem of selecting instrument cathode ray tubes are finding it quicker and easier to check against the Mullard range first. The compact but comprehensive range of six tubes fulfils 85% of all practical requirements. Refer to the foot of this page for free data booklet which gives details of these six and other tubes made by Mullard.

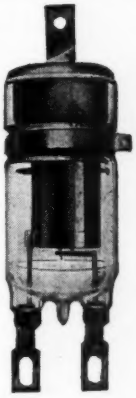


New Heavy Duty Thyratrons

The two new heavy duty thyratrons, XR1–6400A/6807 and XR1–12/5855, embody a new type of construction which provides improved mechanical and electrical performance.

The XR1–12 will continuously control currents of up to 12 amps, while the maximum current rating of the XR1–6400A is 6.4 amps. These two valves are rugged and their long life is backed by a year's guarantee. Their heating-up time is only one minute, and they will operate over a wide range of ambient temperatures.

Post the coupon below for data on both types.

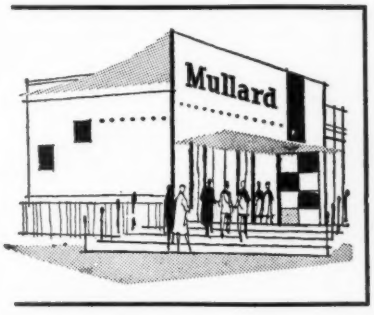


Question and Answer Mullard technical personnel will be present at the following exhibitions to give all possible assistance to visitors in the selection and operation of Mullard products. Valves, tubes and semiconductors will be shown at all exhibitions.

R.E.C.M.F. EXHIBITION, Grosvenor House, 14th–17th April.
Stand Nos. 4, 21 & 22

MULLARD HOUSE EXHIBITION, Torrington Place, 14th–18th April

INSTRUMENTS, ELECTRONICS & AUTOMATION EXHIBITION
Olympia, 16th–25th April. Stand No. 501



Mullard
COMMUNICATIONS AND INDUSTRIAL VALVE DEPARTMENT

MULLARD LIMITED
MULLARD HOUSE · TORRINGTON PLACE
LONDON W.C.1 · LANgham 6633

FOR FURTHER INFORMATION *please write on your company letterhead or pin this coupon to it and mail to Mullard.*

WWI **INFORMATION REQUEST**

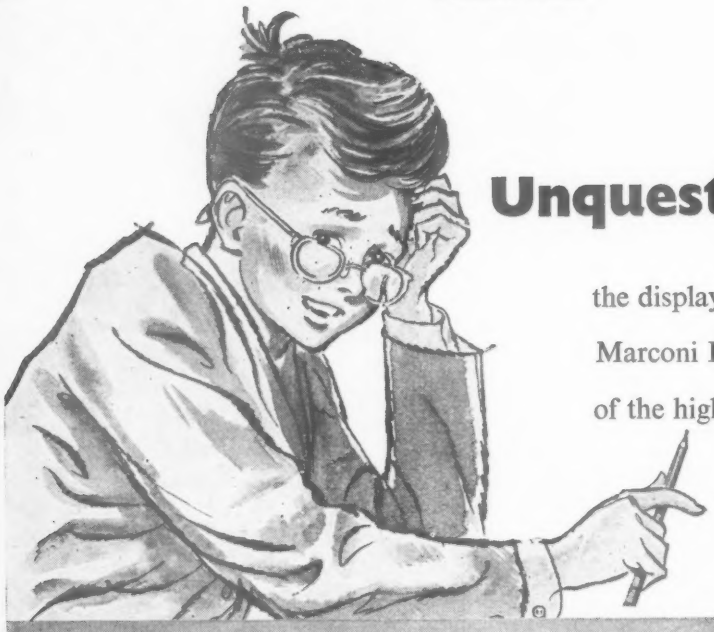
Tick where applicable

- Cadmium Sulphide Photocells ☐
- Double Tetrode QQV02-6 ☐
- Transistor OC16 ☐
- High Voltage Rectifiers ☐
- Instrument Cathode Ray Tubes ☐
- Heavy Duty Thyratrons ☐

NAME .....

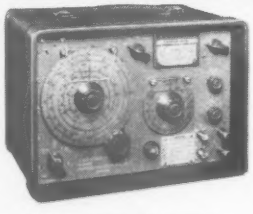
DEPARTMENT .....

MVT345a



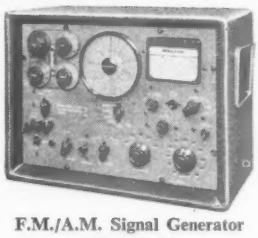
Unquestionably...

the display of equipment from the Marconi Instruments range is one of the highlights of the exhibition.



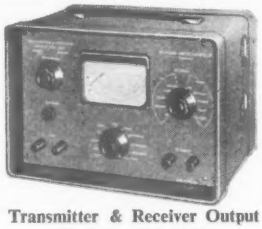
V.H.F. Signal Generator TF 1064

68 to 470 Mc/s, F.M. and A.M. Also I.F. and A.F. outputs. For mobile radio testing.



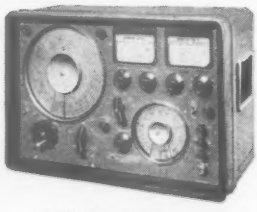
F.M./A.M. Signal Generator TF 995A/4

1·5 to 220 Mc/s. Narrow deviation and extra-fine tuning for mobile radio testing.



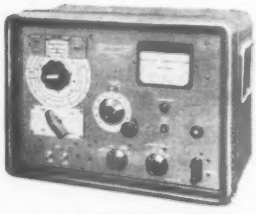
Transmitter & Receiver Output Test Set TF 1065

Checks r.f. power and deviation to 500 Mc/s; a.f., power, and d.c. volts and amps. Complementary to TF 1064 and TF 995A/4.



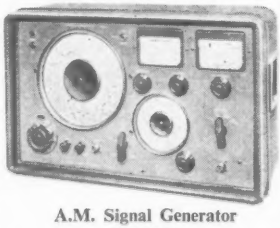
F.M. Signal Generator TF 1066A

10 to 470 Mc/s. F.M. deviation up to 100 kc/s. Direct-reading incremental control.



Carrier Deviation Meter TF 791C

Carrier range 4 to 540 Mc/s. Measures deviation up to 125 kc/s.



A.M. Signal Generator TF 801C

10 to 500 Mc/s. A.M. up to 90%, and pulse mod.

The above Marconi instruments are among those displayed at

STAND No. 405, GROUND FLOOR, GRAND HALL, OLYMPIA

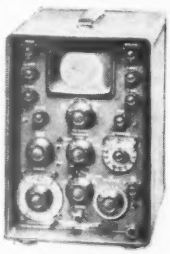
INSTRUMENTS, ELECTRONICS & AUTOMATION EXHIBITION · LONDON 16-25 APRIL 1958

FULL DETAILS OF ALL MARCONI INSTRUMENTS AVAILABLE

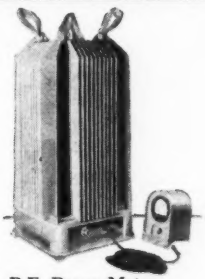
MARCONI INSTRUMENTS

It's that know-all of a boy again. He's not only a walking encyclopedia on our wide range of general-purpose instruments, but he also knows that specialized systems-instrumentation equipment is a prominent feature of our exhibition presentation.

The instruments pictured here are only some of the many different types to be seen on our stand.

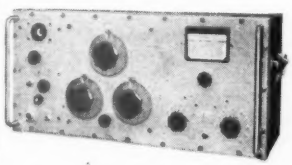


V.H.F. Alignment Oscilloscope TF 1104
For r.f., i.f., and video response analysis in v.h.f. bands I, II & III.

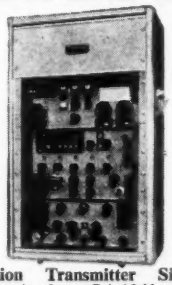


R.F. Power Meter TF 1205
500 watts, 0 to 500 Mc/s, 50Ω. Compact oil-filled unit.

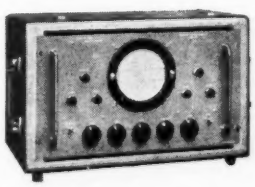
R-C Oscillator TF 1101
20 c/s to 200 kc/s. Output monitored and variable up to +28 dBm in 600Ω.



High Discrimination Oscillator TF 1168
90 to 110 kc/s with precision tuning. For alignment of a.f.c. and discriminator stages in h.f. point-to-point receivers.



Television Transmitter Sideband Analyser OA 1241
For measuring overall responses in band I or band III.



Derivative Test Set OA 1259 (Display Unit)
For checking modem linearity in multi-channel link installations.

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTFORDSHIRE · ENGLAND

London and the South: Marconi House, Strand, London, W.C.2. Tel: COVent Garden 1234
Midlands: Marconi House, 24 The Parade, Leamington Spa. Tel: 1408. North: 30 Albion Street, Kingston-upon-Hull. Tel: Hull Central 16347. Head Office and Works: St. Albans, Hertfordshire. Tel: St. Albans 56161.

TC122

Communication Acoustics

A statement to...

Air Line Operators
Air Traffic Control Operators
Aircraft Manufacturers
Aircraft Communication Equipment Manufacturers
Dictating Machine Manufacturers
Government and G.P.O. Communications Engineers
Hearing Aid Manufacturers
Safety and Personnel Officers in Industry
Telecommunications and Electronics Engineers
Television and Broadcasting Studio Engineers

We are manufacturers of...

Communication Systems · Headphones and Headsets
Earphone and Microphone Inserts
Communication Helmets · Stethophones
Microphone Assemblies · Audiometers
Ear-Defenders · Extruded Cordage and Cables

Enquiries to:

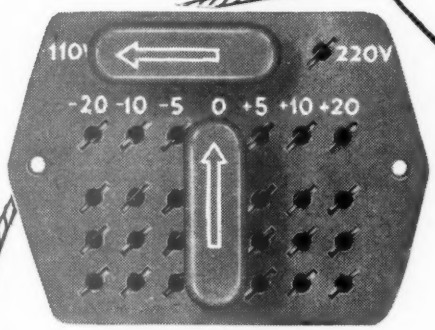
AMPLIVOX LIMITED INDUSTRIAL DIVISION

52-53 Margaret Street, London W.1.
Telephone: LANgham 7918

MARKINGS IN WHITE TO CUSTOMERS' REQUIREMENTS

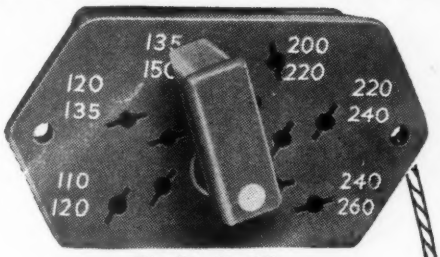
McMURDO
Multi-Way Voltage Selectors

14 WAY
Type B279001
BLACK
P.F. MOULDING



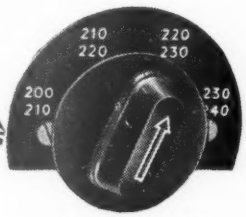
3 Pin Shorting Plugs

6 WAY
Type XVS/6
NYLON LOADED P.F. MOULDING



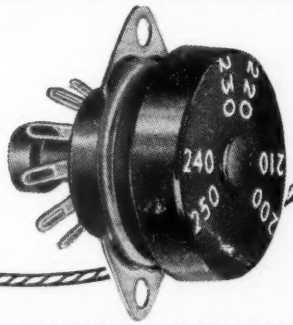
3 Pin Shorting Plug

4 WAY
Type BVS/4
BLACK P.F. MOULDING



3 Pin Shorting Plug

6 WAY
MINIATURE
Type BMVS/6
BLACK P.F. MOULDING



Standard B9A (Noval) Valveholder with 2 Pin Captive Shorting Plug

Send for full details to :—

THE McMURDO INSTRUMENT CO. LTD., ASHTEAD, SURREY. Tel: ASHTEAD 3401

MV515

two new Axioms

TO BE

RELEASED and DEMONSTRATED

AT THE

1958 LONDON AUDIO FAIR

APRIL 18th—21st

WALDORF HOTEL, KINGSWAY, W.C.2.

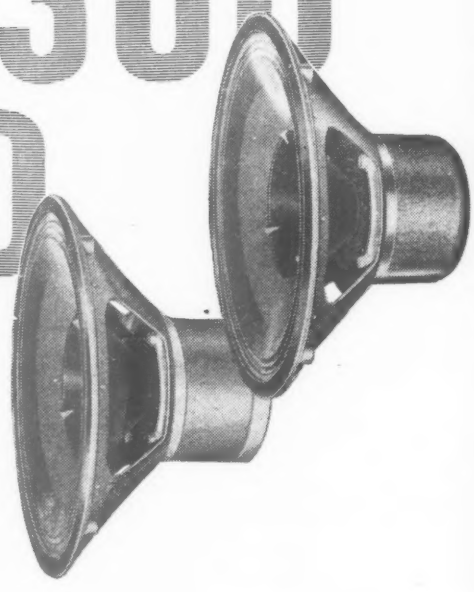
BOOTH No. 20, GROUND FLOOR

DEMONSTRATION ROOM No. 106, FIRST FLOOR

TRADE BUYERS' ROOM No. 105, FIRST FLOOR

Other releases include a new ENCLOSURE for AXIOM 300 and AXIOM 400. Also a completely new, compact, Three-way High Fidelity Loudspeaker System, giving the best performance to price ratio ever offered.

300
400



These most advanced 12 in. twin cone High Fidelity Loudspeakers incorporate design features which reduce distortion to a very low level, providing a more extended and smooth response than previously achieved with this type of unit.

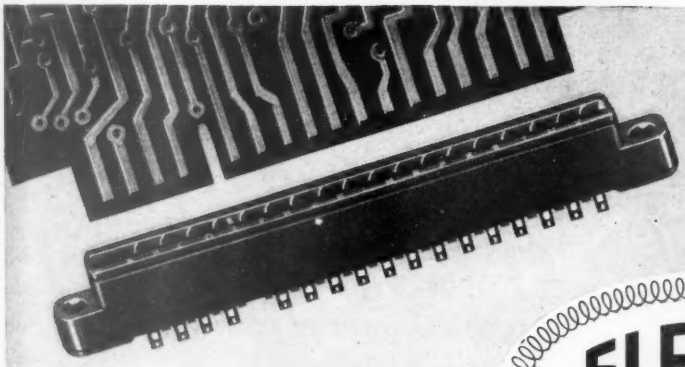
A total range of 30 c/s to 16,000 c/s is covered by two separate concentric diaphragms with mechanical crossover at 5,000 c/s. Each diaphragm is carefully terminated to prevent standing waves and spurious resonances. The drive is by means of a long aluminium coil, suspended in a total flux of 158,000 Maxwells (AXIOM 300), or 195,000 Maxwells (AXIOM 400). Power handling capacities are: AXIOM 300—15 watts; AXIOM 400—20 watts.

GOODMANS

...Europe's largest Manufacturers and the World's largest Exporters of High Fidelity Loudspeakers

GOODMANS INDUSTRIES, LIMITED.
AXIOM WORKS, WEMBLEY, MIDDLESEX.
WEMbley 1200 (8 lines) Grams: Goodaxiom, Wembley, England.

Overseas Agents:
U.S.A.: *Rockbar Corpn. Inc. 650 Halstead Avenue, Mamaroneck, N.Y.*
Canada: *A.C. Simmonds & Sons, Ltd., 100 Merton Street, Toronto 7, Ontario.*
Australia: *British Merchandising (Pty.) Ltd., 183 Pitt Street, Sydney, N.S.W.*



This K-18 connector is
ACTUAL SIZE
—made under U.S. licence from
Winchester Electronics Inc.

ELECTRO METHODS LTD
OF STEVENAGE

— the foremost manufacturers of

printed circuit connectors

NOW AVAILABLE FOR PROMPT DELIVERY

SERIES 'K'
with 6, 12, 18 & 22 contacts
CONTACT CENTRES .156"
END FIXING
Solder-cups or rivet ends

*

SERIES 'KKM'
with 6, 10, 12, 15, 18 & 22 contacts
CONTACT CENTRES .156"
END FIXING
Solder-eyelets

*

SERIES 'KM'
with 14, 21, 31 & 37 contacts
CONTACT CENTRES .078"
END FIXING
Solder-eyelets

*

Polarising-pins can be fitted in any position (This applies to each series)

GOLD-PLATED CONTACTS
made from spring-tempered phosphor-bronze
provide low contact-resistance, prevent corrosion and facilitate soldering.

MELAMINE MOULDINGS
conforming to B.S.S. 1322
provide high arc-resistance, high dielectric and mechanical strength.

Full technical data and illustrated leaflets forwarded on request:
ELECTRO METHODS LTD.
12-36 Caxton Way, Stevenage, Herts.
Telephone: Stevenage 780

A NEW RANGE OF
"Miniature" Instruments

Above: 2" square moving coil voltmeter

★ **DESIGNED TO HARMONISE WITH ALL MODERN ELECTRONIC EQUIPMENT**

★ **FIXINGS CONFORM TO ACCEPTED PRACTICE**

★ **PRICES ARE HIGHLY COMPETITIVE**

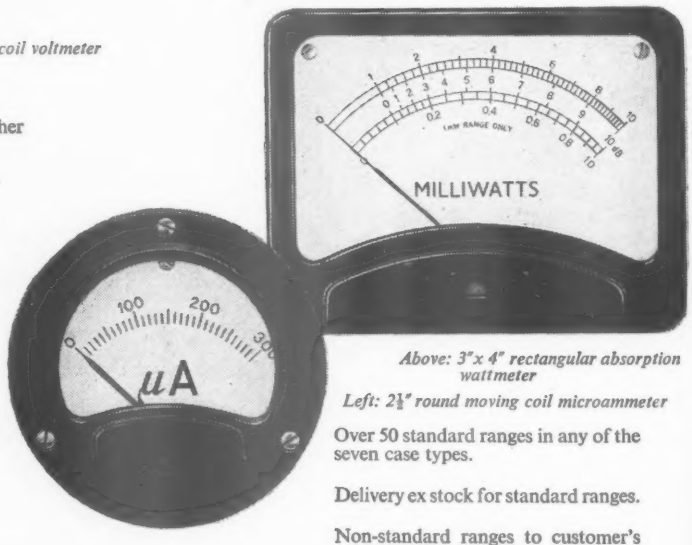
For utmost reliability all 'ENGLISH ELECTRIC' miniature instruments have been designed with a higher-than-normal torque/weight ratio in combination with lower power consumption. All types have been successfully subjected to the following tests:
RESISTANCE TO IMPACT SHOCK OF 200g in any plane.
VIBRATION FATIGUE TEST—two million cycles at peak resonant frequency.
OSCILLATORY TEST—up to one million operations.

SPECIFICATIONS B.S. 89–1954 and other International Specifications.

TYPES
Moving coil for D.C. applications.
Rectifier moving coil for A.F. applications.
Thermo-couple operated moving coil for R.F. applications.

SIZES
Square: 2", 2½" and 3½" nominal scale length.
Round: 2½" and 3½" nominal scale length.
Rectangular: 5" x 6" or 3" x 4" nominal case size.

Design registrations pending.



Above: 3"x 4" rectangular absorption wattmeter

Left: 2½" round moving coil microammeter

Over 50 standard ranges in any of the seven case types.

Delivery ex stock for standard ranges.

Non-standard ranges to customer's specification within 21 days.

Literature available on request to The ENGLISH ELECTRIC Co. Ltd., Instrument Department, Stafford.

'ENGLISH ELECTRIC'

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2
Meter, Relay and Instrument Division, Stafford
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

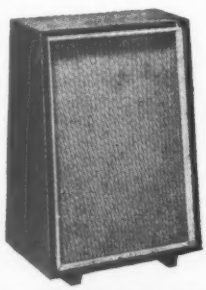
INS.40CB

PYE

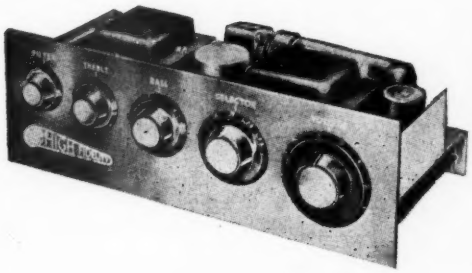
Mozart

10 watt amplifier

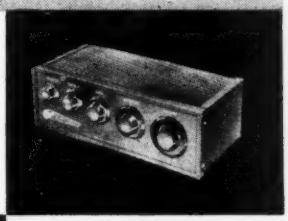
The revolutionary new Pye Mozart is one of the smallest and most compact amplifiers ever devised for the home. Ingenious printed circuit design and simplified circuitry have made possible an undistorted output of 10 watts from a chassis which measures only 10½" x 3⅜" x 5" overall. Used with the specially designed matching loudspeaker system, Model HF12SMT, the Mozart offers the enthusiast the basis of a craftsman-built high fidelity system at very reasonable cost



The creative mind of the scientist . . . in the hands of the craftsman.

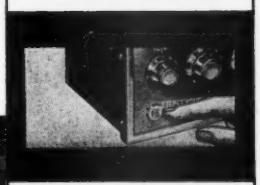


The Mozart is available in chassis form (weight 8½ lbs.) and enclosed in a metal open-work case (9 lbs.). Control panel in copper finish.



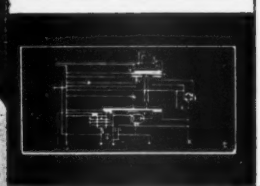
Dialomatic Selector

The Mozart has input facilities for records, tape and radio. New 'dialomatic' pick-up compensation unit gives instant matching for most types of pick-up.



On/Off Push Button

This is completely separate from the volume control and eliminates all mains interference.



Simplified Circuitry

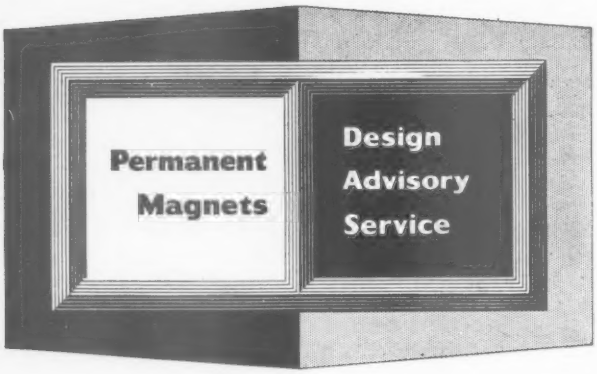
This brilliantly simplified printed circuit uses only 3 valves, a metal rectifier and a minimum of capacitors and resistors, allowing a great saving of space.

PYE LIMITED OF CAMBRIDGE

PYE

PRINTED CIRCUIT RELIABILITY

Pye Limited, Auckland, C.1. New Zealand.
Pye Pty. Ltd., Melbourne, Australia.
Deutsche Pye G.m.b.H., Berlin-Zehlendorf-West, Roonstrasse 2, Germany.
Pye (Ireland) Ltd., Dublin, Eire.
Pye Limited, Mexico City.
Pye (Canada) Ltd., Northline Road, Toronto.
Pye Corporation of America, 1149 Raritan Avenue, Highland Park, New Jersey, U.S.A.



The Modern Theory of Permanent Magnets

No. 1

Advertisements in this series deal with general design considerations. If you require more specific information on the use of permanent magnets, please send your enquiry to the address below, mentioning the Design Advisory Service.

This article is designed to help towards a better understanding of the changes that take place inside a permanent magnet when it is placed in a magnetic field.

According to present theory a magnetic material consists of a number of elemental magnets known as domains. If the material is unmagnetised the magnetic fields from the domains cancel out, due to their random arrangement, so that the collective field is zero. To magnetise the material, it must be subjected to a magnetic field of sufficient intensity to rotate the domains and bring them into line with the direction of the field. This is known as magnetic saturation and is indicated in Fig. 1 as B_{sat}.

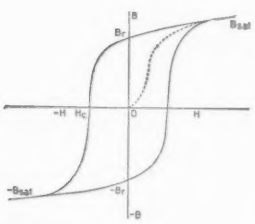


FIG. 1

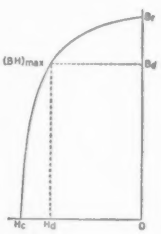


FIG. 2

Fig. 1 shows the familiar hysteresis loop of a ferromagnetic material. It represents a cyclic change in magnetic flux density due to the change in magnetising force.

The area of the hysteresis loop is a measure of the energy stored in the material and for permanent magnets the loop should be as large as possible.

Point O represents a magnet material unmagnetised and the dotted curve shows the increase in magnetic flux density with the increase in magnetising force H.

Saturation, denoted $B_{sat.}$ is the degree of saturation which will produce the maximum area of hysteresis loop. When the magnetising force is reduced to zero, the magnet retains a high proportion of the flux set up and this value, which is the remanant induction in the magnet, is shown as B_r.

If the magnet is then subjected to a de-magnetising force (a magnetising force in the reverse direction) the value of flux will reduce as the de-magnetising force increases, until the flux falls to zero, at H_c. This value H_c is known as the coercive force of the magnet and is the highest value of H to which the magnet can be subjected before the flux in the magnet reverses. By increasing the de-magnetising force still further the magnet will become saturated in the reverse direction at $-B_{sat.}$

If the magnetising force is once more reversed, the flux density will follow in a manner as indicated on the graph.

The second quadrant (Fig. 2) of the hysteresis loop is the curve usually shown to indicate the characteristics of a permanent magnet. The maximum external energy obtainable from a magnet is obtained where the product of the corresponding values of B and H are maximum. These values are usually designated B_d and H_d and are the values recommended for design purposes.

Partial de-magnetisation of the magnet will occur if ferromagnetic objects come into contact with its sides. This treatment not only alters the direction of magnetisation of the domains, thus decreasing the useful flux at the pole faces, but is liable to cause instability. It is important, therefore, that ferromagnetic objects are kept away from magnetised magnets.

Mullard

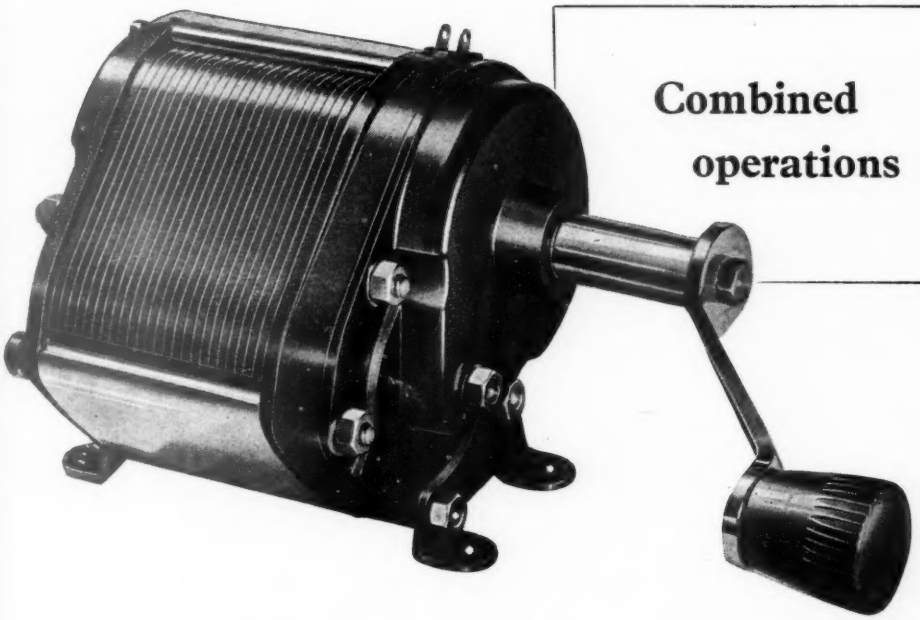
Mullard

'TICONAL' PERMANENT MAGNETS
'MAGNADUR' CERAMIC MAGNETS
FERROXCUBE MAGNETIC CORES

See us at the R.E.C.M.F. Exhibition
Stand 22
Grosvenor House
April 14th—17th

MULLARD LIMITED, COMPONENT DIVISION, MULLARD HOUSE, TORRINGTON PLACE, W.C.1
MC 264A

In a single application, Araldite epoxy resins combine such diverse functions as bonding, impregnating, insulating and providing surface finishes of remarkable protective value. This rotating magnet generator, made by Ericsson Telephones Limited for telecommunication equipment, has a greater output than other generators of the same drive torque. It incorporates heavy-gauge iron sheet laminations bolted between diecast alloy end cheeks, and the coil is separately wound on to a moulded bobin which, when assembled, forms an integral part of the lamination structure. Dimensional accuracy between the end cheeks must be combined with a relatively large dimensional tolerance on the thickness of the laminations, and Araldite Surface Coating Resins have proved indispensable for impregnating the coil, locking the laminations, and imparting an excellent surface finish to equipment which also conforms to tropical specifications.



Combined operations

Araldite epoxy resins are used

- ★ for bonding metals, porcelain, glass, etc.
- ★ for casting high grade solid electrical insulation
- ★ for impregnating, potting or sealing electrical windings and components
- ★ for producing glass fibre laminates
- ★ for making patterns, models, jigs and tools
- ★ as fillers for sheet metal work
- ★ as protective coatings for metal, wood and ceramic surfaces

Araldite *epoxy resins*

Araldite is a registered trade name

Aero **R**esearch **L**imited *A Ciba Company, Duxford, Cambridge. Telephone Sawston 2121*

For EXPORT

FULL ERECTING EQUIPMENT AS USED BY US FOR 100' MASTS. FULL DESCRIPTIVE INSTRUCTIONAL DRAWINGS.
Brit. Pat. No. 705598/52

For T.V.

25', 40', & 55' MASTS FOR DEALERS' OWN ERECTION

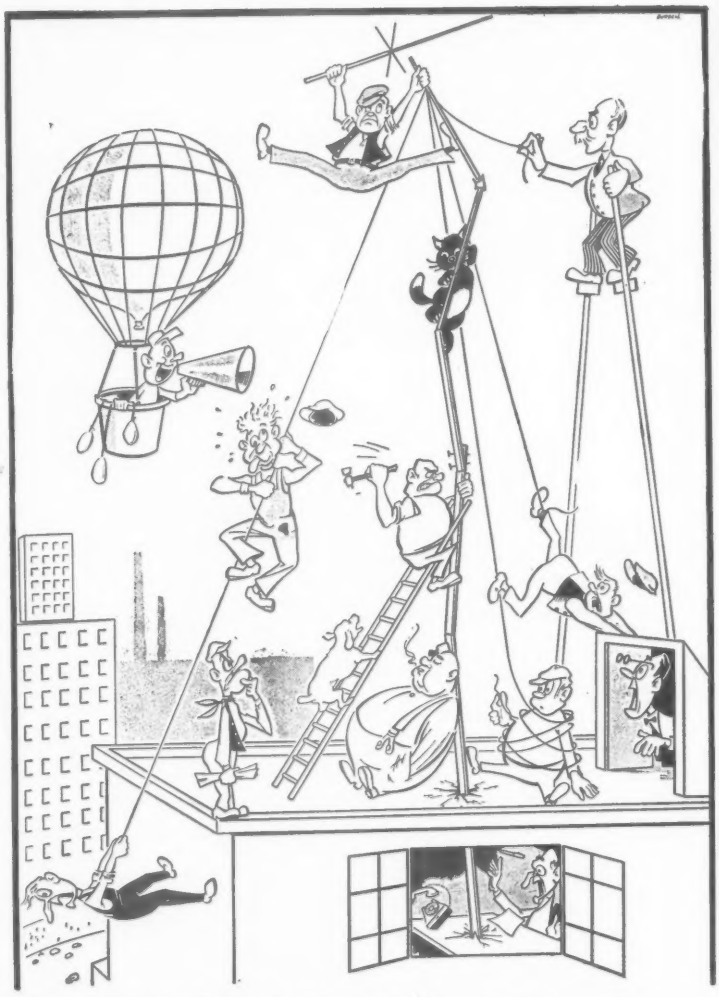
For R.T.

COMPLETE V.H.F. AERIAL SYSTEMS PLANNED AND ERECTED.

ONE YEAR GUARANTEE OF AERIALS AND MAST.

NEW BROCHURE NOW AVAILABLE.

PLEASE STATE AERIAL SYSTEM TO BE USED.



Somebody hasn't heard of...

SKY-MA

(In association with Radio Telephone Aerial Systems Ltd.)

BEADON ROAD, LONDON, W.6

Tel: RIVerside 7878 & 1124

Agents for Scotland & N. Ireland:

WOLSEY TELEVISION (SCOTLAND) LTD.,
142 NORTH STREET, GLASGOW, C.3.
Tel: City 7616

& SKY-BEAM AERIALS

ASTS

PHOTOGRAPH Erecting 100' Mast on 100' high Manchester Guardian Building.

Photo by Manchester Guardian & Evening News Ltd.

One battery
THIS SMALL
is all the power needed to operate a transistor radio

Single-battery operation offers advantages to designer, manufacturer and consumer alike—the saving of space . . . the elimination of multiple connections . . . and foolproof fitting. The PP4 is just one of a range of lightweight, long life Batrymax Power Packs developed by Ever Ready to power all transistor equipment at low cost.

For details telephone or write to: *Sales Department (Technical Service) The Ever Ready Co. (Great Britain) Ltd. London, N.7. Tel: ARChway 3030*

EVER READY
REGD TRADE MARK

POWER PACKS *for* EXTRA *life!*

XUM

The first frequency changer valve specially designed for printed circuit turret tuners

The use of printed circuits in television turret tuners offers attractive advantages both from the quality and performance of the product and the reproducibility of performance. Printed circuits, however, limit the scope of wiring connections mainly to two dimensions instead of the three dimensional freedom of normal wiring and the existing connections of frequency changer valves are not very suitable for use with the existing cascodes. In order to realise the expected improvement in performance both the basing connections of the pins and the internal connections in the valve have to be optimised. The new Ediswan Mazda 30C13 has been specially designed to overcome these problems and give improved performance in gain and stability, particularly in Band III.
Samples and preliminary technical information on the 30C13 will be available at an early date to Set makers only. Our Application Laboratories will be pleased to discuss your problems.

EDISWAN

MAZDA

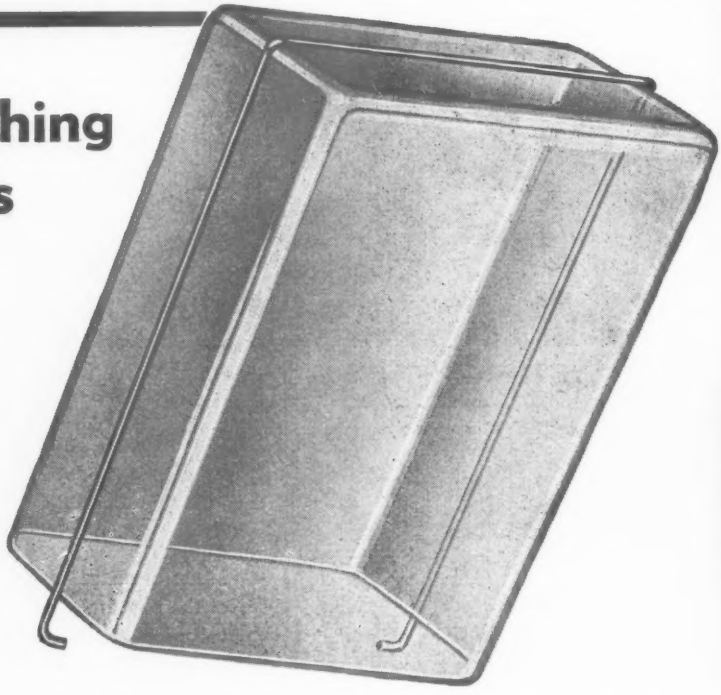
valves and cathode ray tubes

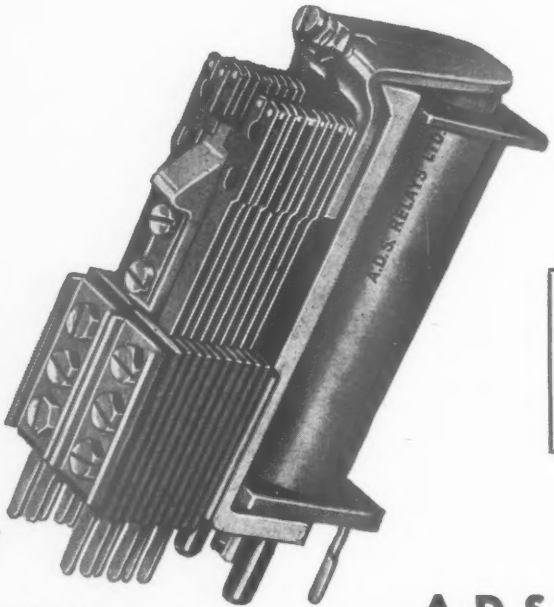
SIEMENS EDISON SWAN LTD.
VALVE AND CATHODE RAY TUBE DIVISION
155 CHARING CROSS ROAD LONDON W.C.2

An A.E.I. Company

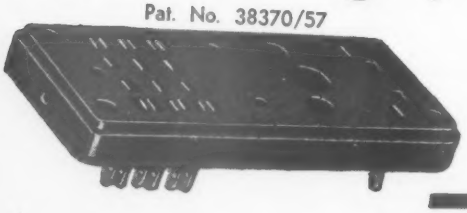
XUM

There's nothing new in this relay EXCEPT—





Pat. No. 38370/57



Visit our STAND
No. 936
at the
I.E.A. EXHIBITION

A.D.S. RELAYS Ltd.

12, Store Street, London, W.C.1.

Tel: MUSeum 2453

TELEVISION AND RADIO FOR THE DEAF

The Adaphone unit, which can be connected to any television or radio set, enables deaf people to hear programmes without raising the volume of sound to a pitch that is unbearable to those with normal hearing. What's more, as the Adaphone cannot pick up the other noises in the room, the listener enjoys completely clear reception. The input is matched for 2 to 10 ohms connection and the transformer through which the signals pass has been tested to withstand 2,000 volts D.C. so that the unit can be used with complete safety on both A.C. and D.C. sets. The volume can be adjusted to individual requirements without affecting the volume from the loudspeaker. Tone control is obtained by alternative output sockets, producing either a normal or high response. The Adaphone is normally supplied with a 30 to 40 ohms impedance insert-type magnetic miniature receiver. Alternatively a bone conductor receiver can be supplied at a small additional cost.

MODEL M4 Complete with miniature earpiece, standard earmoulds and leads **£4.19.0**
MODEL M3 Incorporating Automatic Volume Compression, complete as above **£5.15.0**
MODEL M5 With Independent Loudspeaker Switch for Silent Listening, complete **£5.15.0**

The *multitone* Adaphone

Multitone Electric Co. Ltd., 12-20 Underwood Street, N.1. Tel: CLErkenwell 8022

CRC 22

ADCOLA

PATENTEES & SOLE MANUFACTURERS
(Regd. Trade Mark)

SOLDERING INSTRUMENTS
& ALLIED EQUIPMENT

ILLUSTRATED
DETACHABLE
1/16" BIT MODEL
LIST NO. 64

Protective Shield List No. 68

CATALOGUES HEAD OFFICE SALES & SERVICE

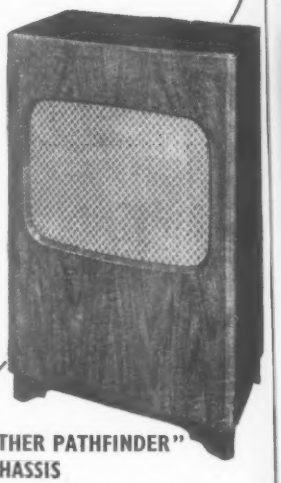
ADCOLA PRODUCTS LTD.,
GAUDEN ROAD,
CLAPHAM HIGH ST.,
LONDON, S.W.4.

TELEPHONES:
MACaulay 3101
& 4272

DYNATRON

for High Fidelity listening

LOUDSPEAKER UNIT CLS 10



For use with high fidelity audio equipment, this enclosure is designed to function as a bass reflex chamber. The loudspeakers employed are a 12" high-flux bass speaker plus two 5" high-frequency drive units separated by a cross-over filter. Magnificent performance is complemented by the beautifully finished cabinet in walnut veneers.

29 gns.

"ETHER PATHFINDER" CHASSIS

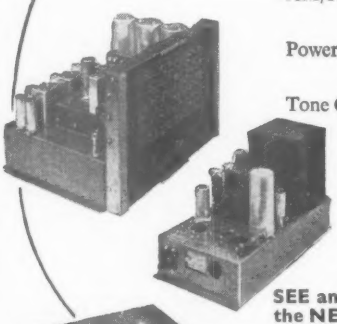
combine facilities for high fidelity listening of gramophone records and the VHF radio broadcasts with all-wave world-wide reception.

The three units comprise:

AM/FM Tuner T10A
£66.0.0

Power Amplifier LF10A
£25.0.0

Tone Control Unit TC10A
£12.17.6



SEE and HEAR these and the NEW ADDITIONS to the DYNATRON range at the LONDON AUDIO FAIR, Waldorf Hotel, London W.C.2, 18th to 21st APRIL. STAND No. 16. Demonstration Room 144.

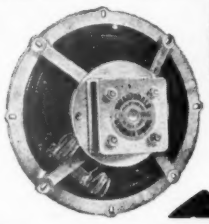
Write for illustrated literature to:
DYNATRON RADIO LTD., Dept. W, MAIDENHEAD, BERKSHIRE

BETTER THAN EVER PERFORMANCE!

Wharfedale
SPEAKERS
with FOAM PLASTIC SURROUNDS

SUPER 3
Flux Density 13,000 gauss
Total Flux 54,000
maxwells.
Price (inc. P.T.) **139/11**

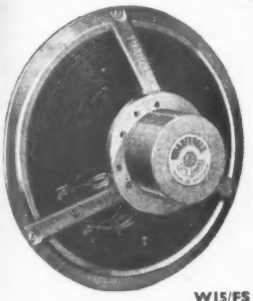
SUPER 8/FS
Bass Resonance 45/55 c/s
Flux Density 13,000 gauss
Total Flux 54,000
maxwells
Price (inc. P.T.) **139/11**



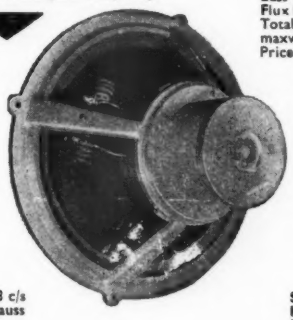
W12/FS
Bass Resonance 30/35 c/s
Flux Density 13,000 gauss
Total Flux 145,000
maxwells
Price (inc. P.T.) **205/-**

10in. BRONZE/FSB
Bass Resonance 30/38 c/s
Flux Density 10,000 gauss
Total Flux 39,500
maxwells
Price (inc. P.T.) **111/3**

8in. BRONZE/FS/AL
Bass Resonance 45/55 c/s
Flux Density 10,000 gauss
Total Flux 39,500
maxwells
Price (inc. P.T.) **91/-**



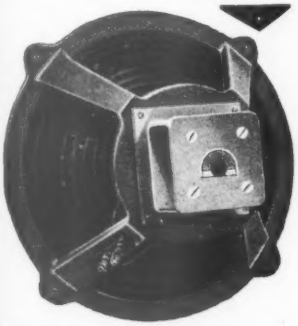
GOLDEN/FSB
Bass Resonance 30/38 c/s
Flux Density 13,000 gauss
Total Flux 54,000
maxwells
Price (inc. P.T.) **174/11**

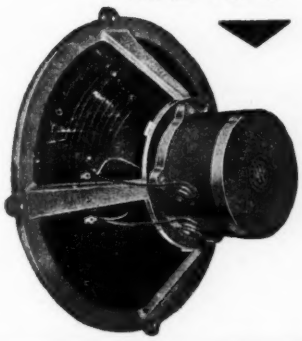


W15/FS
Bass Resonance 25/30 c/s
Flux Density 13,500 gauss
Total Flux 180,000
maxwells
Price (inc. P.T.) **350/-**

W10/FSB
Bass Resonance 30/38 c/s
Flux Density 14,000 gauss
Total Flux 74,000
maxwells
Price (inc. P.T.) **262/4**

SUPER 12/FS/AL
Bass Resonance 30/38 c/s
Flux Density 17,000 gauss
Total Flux 190,000
maxwells
Price (inc. P.T.) **350/-**





8 page cabinet construction sheet free on request.

WHARFEDALE WIRELESS WORKS LTD.
IDLE · BRADFORD · YORKS

Telephone: Idle 1235/6. *Telegrams: Wharfdel, Idle, Bradford.*

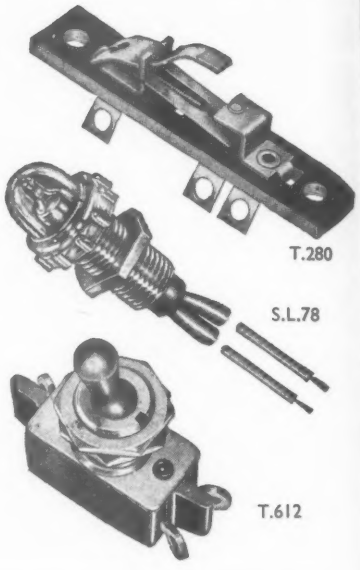
FOAM SUSPENSION—This now replaces cloth on all Wharfedale units. The resilience reduces the incidence of distortion at low frequencies, and the softness improves dissipation of middle and high frequency vibrations at the edge of the cone, resulting in an all-round improvement in the smoothness of response.

ARCOLECTRIC

Sensitive Snap Action Switch T.280
A skeleton switch designed for building into calculating machines, process timers, etc.

Miniature Neon Signal Lamp S.L.78
Designed to be the smallest possible and lowest cost signal Lamp for all mains voltages. Single $\frac{3}{8}$" hole fixing. Colours: Red, Amber or Clear.

3-Terminal Toggle Switch T.612
A completely new three-terminal single pole change-over switch. Silver plated contacts angled out for ease of soldering.



Write for Catalogue 131

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY. Tel.: MOLESEY 4336

THE THIRD LONDON
AUDIO FAIR
AND STILL LARGER
1958

will be the most comprehensive public demonstration of High Fidelity equipment ever staged in this country.

All leading manufacturers will be exhibiting and demonstrating under domestic conditions, the latest developments in audio equipment.

Lovers of music of all types, if they are true to their enthusiasm should hear for themselves how exactly and faithfully their favourite passages can be played back to them.

COMPLIMENTARY TICKETS AVAILABLE FOR EACH DAY FROM YOUR RADIO, MUSIC OR GRAMOPHONE DEALER. IF YOU HAVE ANY DIFFICULTY SEND STAMPED ADDRESSED ENVELOPE AND STATE FOR WHICH DAY TICKETS REQUIRED TO :
Exhibition Office, 42 Manchester Street, London, W.1

THE
LONDON AUDIO FAIR 1958
will be held at the
WALDORF HOTEL
Aldwych, W.C.2
on
Friday 18th
Saturday 19th
Sunday 20th
Monday 21st
APRIL
11 a.m. until 9 p.m.

The latest in the Hi-Fi range

The Elac 4 inch Tweeter

A further addition to the "Elmag" High Fidelity range, this 4in. cone type Tweeter is the finest of its class yet produced. Response to transients is exceptionally good and the absence of undesirable peaks results in clear and smooth reproduction.

For best results it should be used with a suitable cross-over filter in conjunction with 1 or 2 larger units.

Frequency response within 5 dB from 5,000-17,000 cps, only 7½ dB down at 20,000 cps.

OVERALL SIZE: 4in. DIA. x 2⅝in. DEEP.

POWER HANDLING: 2 W. Peak A.D. INPUT.

VOICE-COIL IMPEDANCE: 6 ohms at 5,000 cps.

PRICE: 29/10 inc. P.T.
Trade Terms 33⅓%.

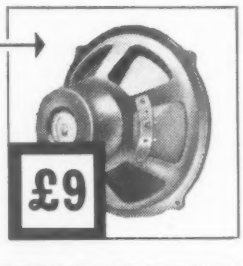
ELAC

ELECTRO ACOUSTIC INDUSTRIES LTD
STAMFORD WORKS BROAD LANE TOTTENHAM LONDON N.15 TEL.: TOTtenham 0505-9

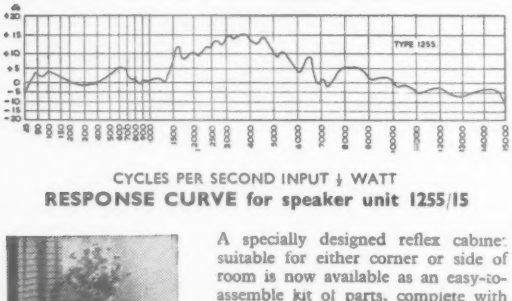
If you understand music...

. . . you will realise that Grampian high fidelity equipment gives you the nearest approach to "Concert Hall listening" in your own home. You will, for instance, appreciate the extraordinary delicacy of reproduction achieved by their new 12in. loudspeaker. A great deal of research and new manufacturing methods were necessary to produce a speaker unit with such an extended audio frequency coverage at such a reasonable cost.

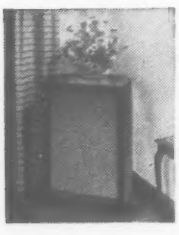
GRAMPIAN
12" SPEAKER UNIT
Type 1255/15



Frequency Range.....20-15,000 c.p.s.
Voice Coil Diameter.....1½in.
Voice Coil Impedance.....15 ohms
Fundamental Resonance.....40 c.p.s.
Power Handling Capacity.....10 watts
Flux Density: 14,500 lines per sq. cm.
Total Flux: 130,500 lines per sq. cm.



CYCLES PER SECOND INPUT ½ WATT
RESPONSE CURVE for speaker unit 1255/15



A specially designed reflex cabinet suitable for either corner or side of room is now available as an easy-to-assemble kit of parts, complete with grille material ready to assemble, stain and polish. Although it is primarily intended for use with the Type 1255/15 speaker the cabinet will give excellent results with other units of similar specifications. Price £11

Deferred terms available if desired for both speaker and cabinet kit!

Full details from:

GRAMPIAN
REPRODUCERS LIMITED

Makers of quality high fidelity equipment
17 HANWORTH TRADING ESTATE, FELTHAM, MIDDLESEX
Telephone: Feltham 2657/8

HI FIDELITY FM RECEPTION..

FM/Y4U
Head only - **£3.7.6d.**

FM/Y4L
4' 6" mast & lashings - **£4.17.6d.**

FM/Y4M
9' mast & lashings - **£7.2.6d.**

FM/Y4 LOFT
£2.17.6d.

demands a fine aerial

Audio engineers and other critical users will find their best answer is a Wolsey FM 4 Element Yagi. These are available in two types and have been carefully engineered to provide optimum signal/noise ratio, whilst maintaining the necessary bandwidth. The folded dipole and reflectors offer a unidirectional directivity pattern, providing high gain combined with mechanical rigidity that have made Wolsey Aerials famous.

PERFORMANCE FIGURES

Forward Gain 8 dBs - - - - - Impedance 70 ohms
Bandwidth - - - - - - - 10 mc/s at 3 dB points
Front to Back Ratio - - - - - - - - - 25 dBs
Acceptance Angle - - - - - - - 90° at 3 dB points

WOLSEY ELECTRONICS LIMITED

CRAY AVENUE · ST. MARY CRAY
ORPINGTON · KENT
TELEPHONE: ORPINGTON 26661-6

(Electronics Division, Gas Purification & Chemical Co. Ltd.)

TRANSISTORS

by Semiconductors

This is the new range of transistors to be manufactured by Semiconductors Limited, in the world's most modern transistor factory, at Swindon, Wiltshire.

All Semiconductors transistors will be identical with Philco types, developed as a result of pioneer research and many years' experience. Previously manufactured only in U.S.A., they are now available for Sterling.

The electro-chemical production techniques to be used in the new factory provide exceptionally tight control of tolerances and allow the use of automatic control and transfer methods, ensuring transistors of consistently high performance and reliability at reasonable cost.

Visitors to the

I.E.A. EXHIBITION

are invited to visit

STAND 618

where technical advice on performance and application of all Semiconductors Limited transistors will be available.

SURFACE BARRIER TRANSISTORS

2 N 344	General Purpose
2 N 345	RF and video amplifier, switching (f max > 30 Mc/s)
2 N 346	RF and video amplifier (f max > 60 Mc/s)
2 N 128	Military RF and video amplifier (f max > 45 Mc/s)
2 N 129	As above, controlled hfb, (f max > 30 Mc/s)
2 N 240	High speed switching (f max > 30 Mc/s)
T–1287	RF and video amplifier (f max > 95 Mc/s)

MICRO-ALLOY TRANSISTORS

2 N 393	Video amplifier and switching, high hfb (f max > 40 Mc/s)

MICRO-ALLOY DIFFUSED TRANSISTORS

2 N 499	VHF oscillator/amplifier 25 mW at 100 Mc/s (f max > 300 Mc/s)
2 N 501	High speed switching (f max > 250 Mc/s)

SILICON ALLOY TRANSISTORS

2 N 495	RF and video amplifier (f max > 8 Mc/s)
2 N 496	High speed switching (f max > 8 Mc/s)

GERMANIUM POWER TRANSISTORS

2 N 352	Audio amplifier (3W class A)
2 N 353	Audio amplifier (5W class A, 10W class B)
2 N 386	60V version of 2 N 353
2 N 387	80V version of 2 N 353

* *ALL ILLUSTRATIONS OF TRANSISTORS ARE ACTUAL SIZE*

NOTE: f max = *maximum frequency of oscillation*

Comprehensive data sheets and application notes are available for all Semiconductors transistors. Engineers and senior executives are invited to write for copies, stating the types of transistors in which they are interested.

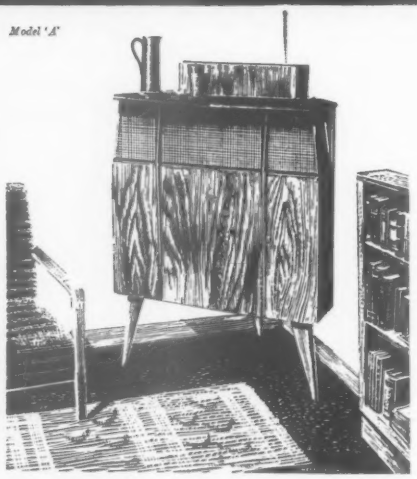
Semiconductors Limited CHENEY MANOR · SWINDON · WILTSHIRE

SC4

CITY SALE & EXCHANGE LTD

The High Fidelity Specialists

Model 'A'



Our Mail Order Service is superb. L.P. Records, Diamond needles and Tape accessories guaranteed by return of post.

LOWTHER T.P.I. CORNER REPRODUCER

This is a very compact speaker and preserves to an amazing degree true relationship between fundamental and harmonics whether it be low or high frequency. Speech is smooth, forward, and gives a feeling of the presence of the artist. Strings, brass and percussion alike have a clarity comparable to a concert hall performance.

Price £96 . 0 . 0

Part Exchange is our speciality. We will give you a fair offer for your present proprietary radio goods against the purchase of either new or secondhand apparatus. This allowance can be used as deposit or part deposit.

If you want a really fine amplifier to go with this speaker, why not the Lowther L.L.16 with Master control unit for same. Prices are £40 and £24 respectively. We can assure you that a demonstration will leave no doubt in your mind that they are well worth it.

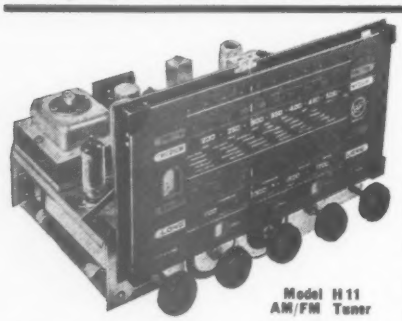
The matching F.M. unit has high sensitivity, negligible radiation and a full dynamic range. Price £30/15/7.

All the Lowther equipment mentioned above and that of leading makes, such as Leak, Rogers, Quad, Wharfedale, etc., are on demonstration in our Fleet Street showrooms.

93-94 FLEET STREET, LONDON, E.C.4 *Phone: FLEet St. 9391/2*

Relax — with DULCI

True concert hall beauty of sound, free from any superfluous and irritating noise, is the basic characteristic of good high fidelity reproduction. The most savage breast and critical ear will be charmed by Dulci equipment—made for the connoisseur by connoisseurs. As to price—relax again—Dulci are as realistic on value as on sound quality. Consider these items from our repertoire.



Model H11 AM/FM Tuner

A combined and self-powered AM/FM Tuner, Control Unit and Audio Pre-Amplifier in one chassis, designed in detail for fine performance. Seven channel selector matching to L.P. and 78 r.p.m. Records and Tape Replay. FM (VHF)—Short, Medium and Long Wavebands. Independent Bass and Treble Controls giving 15db lift and cut with indicated level response position.
Price: **£29/3/10 inc. tax.**

GA 4 High Fidelity Amplifier with control panel 6×4in., switch matching to Radio, L.P. and 78 r.p.m. records. Bass and Treble controls. Volume control.

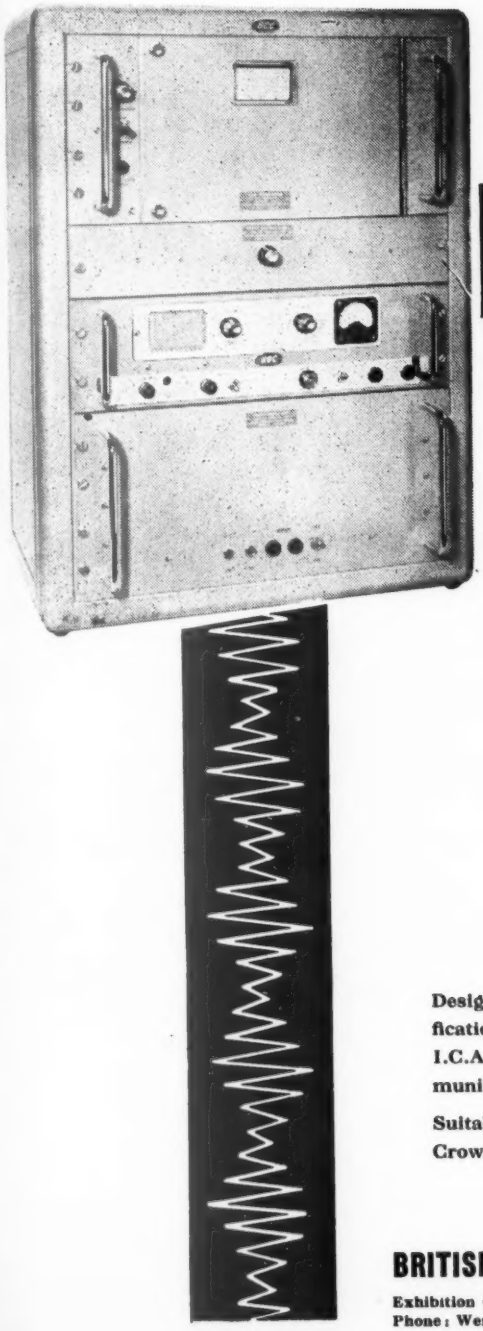
DPA 10 Power Amplifier 10-14 watts. Ultra Linear with choice of control unit or pre-amplifier. A superb laboratory-designed amplifier, modern-styled and of precision quality for domestic use. Incorporates every facility for the reproduction of high quality sound from radio, records, tapes or microphone.

DPA 10 only £12/12/-.
DPA 10 with control unit £15/15/-.
DPA 10 with pre-amplifier £19/19/-.

DISTINCTLY DULCI QUALITY PRODUCTS

THE DULCI COMPANY LIMITED, 97-99 Villiers Road, London N.W.2 Telephone: Willesden 6678/9

BCC



50 WATT V.H.F. FIXED STATION

Type 301/201

- *Frequency coverage from 30-174 Mc/s in eight bands.
- *Noise compensated, relay operated muting circuit in Receiver.
- *Easy to set up: simple to maintain.
- *Designed for continuous operation.
- *May be rack mounted or supplied in steel cabinet.
- *Mains operated from 100-150v. or 200-250v. A.C. 45-65 c/s supplies.
- *Available with local, remote or extension control facilities.

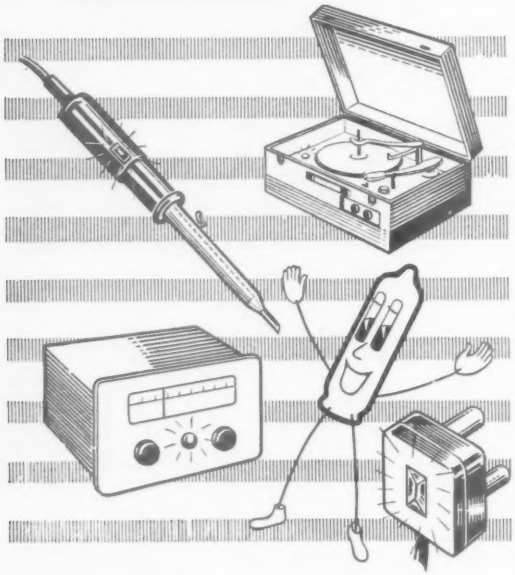
Designed to meet the latest British Post Office specifications for land mobile services, or alternatively, I.C.A.O. recommendation for ground-to-air communication.

Suitable for use in all climates and meets the British Crown Agents' specification, CAS. 118.

BRITISH COMMUNICATIONS CORPORATION LTD

Exhibition Grounds Wembley Middlesex
Phone: Wembley 1212 Grams: Bee Cee Cee

For better indication fit a Hivac neon



With its distinctive colour indication and almost indefinite life, a Hivac Neon is the best indicator for a wide range of domestic and industrial electrical equipment. Its easily seen light serves as a visual check that an appliance is working as required. Look at the advantages:

- Extremely long life without sudden failure
- No filament to break
- Inexpensive and easy to instal
- Shock resistant
- Negligible power consumption
- Operation on a wide range of A.C. or D.C. voltages

It just glows to show!

There's a type for every purpose—write for full details

Hivac Limited

Stonefield Way, South Ruislip, Middx. Ruislip 3366

BH6

i n t e r n a t i o n a l

I E A

e x h i b i t i o n

INSTRUMENTS
ELECTRONICS
AUTOMATION

16-25 APRIL 1958 OLYMPIA, LONDON admission 2/6

You will be welcome at the 1958 Instruments, Electronics and Automation Exhibition.

MORE THAN 250 BRITISH MANUFACTURERS will be showing the latest and most comprehensive range of exhibits.

OVER 100 OVERSEAS EXHIBITORS will be displaying their achievements in the rapidly developing fields of instruments, electronics and automation.

Note the date **NOW.**

I.E.A.— the exhibition no progressive industrialist can afford to miss.

10 a.m. — 6 p.m. daily (Until 9 p.m. Fri. 18th & Wed. 23rd April)

A Conference will be held throughout the period of the I.E.A. Exhibition. Further information regarding both conference and exhibition will be gladly supplied by the organisers:

INDUSTRIAL EXHIBITIONS LIMITED
9 ARGYLL STREET, LONDON, W.1. Tel: Gerrard 1622

G.E.C. CATHODE RAY TUBES

for Oscillography

Photograph reproduced by courtesy of British Communications and Electronics

The recently advertised 4GP., 5BHP and 6EP cathode ray tubes are only three of a wide range of instrument tubes marketed by the G.E.C.

The range includes both electromagnetic and electrostatic deflection tubes and all are generally available with any one of six standard screen phosphors. Other screen phosphors can be supplied to special order.

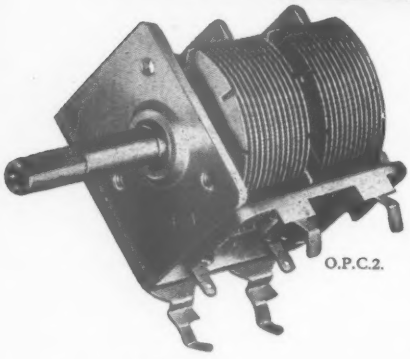
Should you have any cathode ray tube problems—consult the M-O Valve Company. You will most probably find a tube in the range which is ideally suited to your particular application. If not, the Company with its wealth of experience and technical facilities may be able to make a special tube for you.

Some of the many products of the M-O Valve Co. Ltd.

Transmitting Valves
Industrial Heating Valves
Pulse Valves
Audio Frequency Valves
Instrument Valves
High Figure of Merit Valves
Low Noise Valves
Series Stabiliser Valves
Rugged Valves
Vacuum Rectifiers
Mercury Rectifiers
Xenon Rectifiers
Magnetrons
Klystrons
T. R. Cells
Corona Stabilisers
Geiger-Müller Tubes
Special Purpose Cathode Ray Tubes
Radar Cathode Ray Tubes

Products of the M.O. Valve Company Limited, Brook Green, Hammersmith, London, W.6 a subsidiary of
THE GENERAL ELECTRIC COMPANY LIMITED

NEW CONDENSER FOR PRINTED CIRCUIT MOUNTING



O.P.C.2.

Stator terminals and earthing tags for frame and rotor are formed to provide resilient plug in mounting, for use in printed circuit technique. Provides instantaneous and accurate location which retains the component firmly until soldering is completed, no tags or wires to bend or clench.

Resilient stator tags make it possible to unsolder and remove if necessary. Trimmers are provided as standard (2-25pf). Specification otherwise same as for "O" gang.

It's Reliable if it's made by Jacksons.

REGISTERED TRADE MARK

JACKSON BROS. (LONDON) LTD KINGSWAY · WADDON · SURREY

Telephone Croydon 2754/5

ELECTRO-MAGNETIC RELAYS?..

Send to Simmonds!

who have a range of 1000 NEW TYPES by MTI (Materiel Technique Industriel)

Delivery 14-27 days for most types

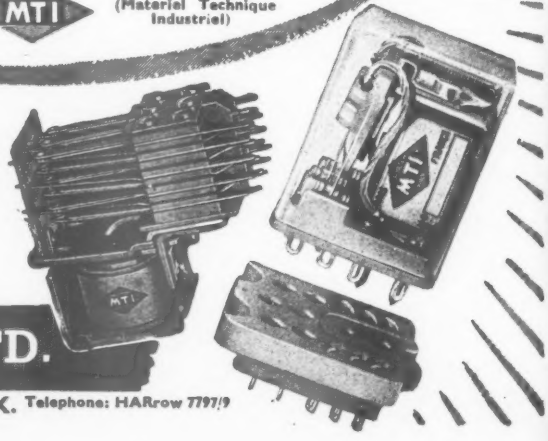
★ Operating from **1 Milliwatt** to **1 Kilowatt** with up to **96 change-overs at 10 amps. per contact.**

★ Most models can be fitted with dust covers or hermetically sealed.

★ Range includes certain models hermetically sealed, all metal gas filled with glass base, and built-in adjustable thermal delay.

★ **Post Office types 3000 and 600 relays of our own manufacture to specification. Guaranteed to full A.I.D. and I.E.M.E. standards.**

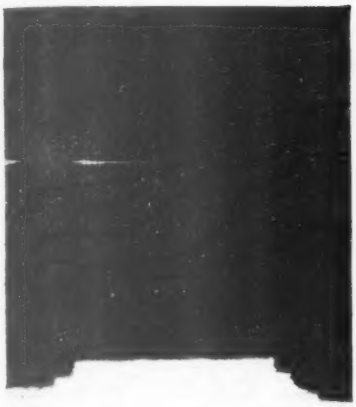
Sole concessionaires for U.K. and Dominions on behalf of M.T.I.



L. E. SIMMONDS LTD.

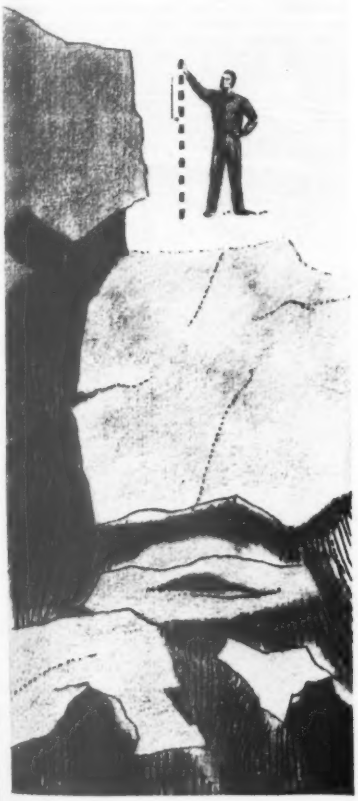
5 BYRON ROAD, HARROW, MIDDLESEX. Telephone: HARrow 7797/9

(Manufacturers and Trade enquiries only)



GNE. 510 H.F. transmitter receiver

Flexibility is the dominant design characteristic of the new Mullard 40 watt H.F. Transmitter/Receiver. With its wide frequency coverage, interchangeable power supply units and comprehensive services, the GNE.510 is ideal for medium distance communication in a variety of fields; it can be operated as a fixed station or as a temporary mobile link. It is available with a choice of built-in power supply units for 12 or 24V battery, a.c. or d.c. mains and has eight crystal transmitter frequencies with preset tuning. For further details write to the address below.



Mullard
SPECIALISED ELECTRONIC EQUIPMENT

MULLARD LIMITED
Equipment Division
Mullard House
Torrington Place
London · W.C.1

ME603a

Dear Sir,

It gives us great pleasure to answer your enquiry regarding the telecommunication equipment. Our instruments are built to a rigorously high standard, and we are confident that you will find the apparatus you need in our complete catalogue.

The Marconi Instruments wide range of test equipment is indicative of the Company's outstanding capacity to satisfy the requirements of electronic instrument users, for it includes more than 100 items covering from VLF to EHF - signal generators, frequency meters, voltmeters, power meters, deviation meters, oscilloscopes, spectrum and response analysers, Q-meters, bridges, and test equipment for systems instrumentation.

Whatever your needs in these fields, Marconi Instruments are always at your service.

PS. *Marconi Instruments Ltd., are represented in sixty-eight countries*

Principal Laboratories and Works:

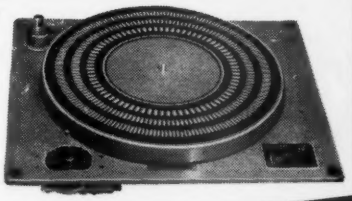
MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTS · ENGLAND · TEL: ST. ALBans 56161
TC 121

Connoisseur
SOUND PRODUCTS

We make no extravagant claims for Connoisseur products, all we ask is that you listen to them and judge for yourself. They are not cheap but then the best never is. Look at the specifications.

Connoisseur Variable 3-speed Gramophone Motor

Mechanical speed change without braking provides 4% variation at all speeds. Synchronous motor is virtually vibrationless. Main spindle runs in phosphor bronze bearings. Turntable is full 12" lathe turned from non-ferrous material.



Connoisseur Pick-up

With three interchangeable heads for micro-groove, standard and older records, available with Diamond or Sapphire Stylus.

Frequency range 25-20,000 cps ± 2 dB's, 400 ohms Model gives 15 M.V. output from the average LP disc ; 25 M.V. from a standard 78 rpm recording.

Connoisseur HQ 20 Amplifier and Pre-amplifier

Both units are built to the highest electrical and mechanical standards and incorporate the latest developments in Audio technique. High Power output allows the reproduction of peak passages without overload or distortion.

Connoisseur

Send for descriptive leaflets
Well Green Lane,
Brighouse, Yorkshire.
Tel: Brighouse 2397

A. R. SUGDEN & CO (Engineers) LIMITED

See our list of overseas agents on page 65.

BOOKS ON RADIO

TRANSISTOR A.F. AMPLIFIERS

D. D. Jones, MSC., DIC, and R. A. Hilbourne, BSC. This book, the first of its kind to be published in Great Britain, deals systematically with the design of transistor audio-frequency amplifiers, and gives the circuitry and design details of a versatile range of amplifiers, including both those for high fidelity reproduction and for public address systems. Essential to engineers designing transistor audio amplifiers for the first time.
21s net by post 21s 10d

WIRELESS SERVICING MANUAL

W. T. Cocking, MIEE. This, the ninth edition of a standard work which has come to be recognised as a reliable and comprehensive guide for amateur and professional alike, has been thoroughly revised and set in a larger and handier format. Essential testing apparatus is described, and logical methods of deducing and remedying defects are explained.
17s 6d net by post 18s 8d

SECOND THOUGHTS ON RADIO THEORY

Cathode Ray of "WIRELESS WORLD." Forty-four articles reprinted from the popular "WIRELESS WORLD" series, in which the author examines various aspects of elementary radio science, explains them clearly, and shows that there may be more behind them than is apparent from the usual text-book. This volume deals with basic ideas; circuit elements and techniques; circuit calculations; and some matters in lighter mood.
25s net by post 26s 4d

ADVANCED THEORY OF WAVEGUIDES

L. Lewin. Sets out the various methods that have been found successful in treating the types of problems arising in waveguide work. The author has selected the number of topics as representative of the field in which the micro-wave engineer is at present engaged.
30s net by post 31s

BASIC MATHEMATICS FOR RADIO AND ELECTRONICS

F. M. Colebrook, BSC, DIC, ACGI. Revised and enlarged by J. M. Head, MA (CANTAB). Presents in readable form a complete course in basic mathematics for engineering students of all kinds and leads on to the more advanced branches of mathematics of increasing importance to radio engineers. In this revised edition the chapter covering the application of mathematics to radio has been enlarged, and many new subjects are included.
17s 6d net by post 18s 6d

ABACS OR NOMOGRAMS

A. Giet Translated from the French by H. D. Phippen and J. W. Head. This book not only demonstrates the many and varied applications of the abac or nomogram, but shows how even those without highly specialised mathematical knowledge may construct their own charts. It deals with both Cartesian abacs and alignment charts and contains a large number of practical examples in mechanics, physics and electrical engineering.
35s net by post 36s

Published by Iliffe & Sons Ltd Dorset House, Stamford St. London SE1

OVER
U.S.A
CANA
Toron
Head
The H

XUM

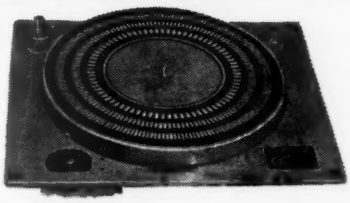
Connoisseur

SOUND PRODUCTS

We make no extravagant claims for Connoisseur products, all we ask is that you listen to them and judge for yourself. They are not cheap, but then the best never is. Look at the specifications.

Connoisseur Variable 3-speed Gramophone Motor

Mechanical speed change without braking provides 4% variation at all speeds. Synchronous motor is virtually vibrationless. Main spindle runs in phosphor bronze bearings. Turntable is full 12in. lathe turned from non-ferrous material.

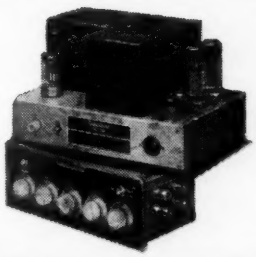


Connoisseur Pick-up

With three interchangeable heads for microgroove, standard and older records, available with diamond or sapphire stylus.
Frequency range 25-20,000 cps ± 2 dB's, 400 ohms model gives 15 M.V. output from the average LP disc, 25 M.V. from a standard 78 r.p.m. recording.

Connoisseur HQ 20 Amplifier and Pre-amplifier

Both units are built to the highest electrical and mechanical standards and incorporate the latest developments in Audio technique. High Power output allows the reproduction of peak passages without overload or distortion.



Connoisseur

OVERSEAS AGENTS:

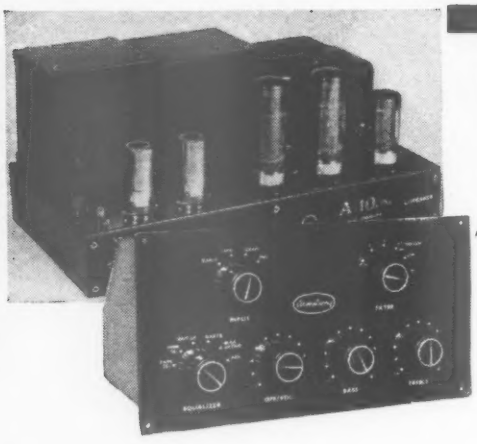
U.S.A.: Ercona Corporation, 551 Fifth Street, New York 17, N.Y. CANADA: The Astral Electric Co. Ltd., 44, Danforth Road, Toronto 13, Ontario. NEW ZEALAND: Turnbull & Jones Ltd., Head Office: 12/14, Courtenay Place, Wellington. HONG KONG: The Radio People Ltd., 31, Nathan Road, Hong Kong.

Send for descriptive leaflets :

A. R. SUGDEN & CO. (ENGINEERS) LTD.
WELL GREEN LANE BRIGHOUSE · YORKSHIRE
Phone: Brighouse 2397.
Grams: Connoisseur, Brighouse.

MAIN DISTRIBUTORS:
AUSTRALIA: British Merchandising Pty. Ltd., 183, Pitt Street, Sydney, and J. H. Magrath (Pty.) Ltd., 208, Little Lonsdale Street, Melbourne. EAST AFRICA: International Aeradio (East Africa) Ltd. P.O. Box 3133, Nairobi. MALAYA: Eastland Trading Co., 1, Prince Street, Singapore.

E



Armstrong A10
MARK II

HIGH FIDELITY AMPLIFIER & PRE-AMPLIFIER CONTROL UNIT

BRIEF SPECIFICATION *Output:* 10 watts rated; 20 watts peak. *Frequency Response:* 10-100,000 c.p.s., within 1dB 15-30,000 c.p.s. *Distortion:* less than 0.1%. *Damping Factor:* 40. *Hum Level:* Better than 80dB down. *NFB:* 3 loop, main overall loop 28dB. *Sensitivity:* 8mV (Gram input A) for 10 watts. *Spare Power Supplies:* 320v, 45mA and 6.3v, 2A. *Valves:* Pre-Amp ECC83, EF86. Amplifier GZ34, ECC85, EF86, 2 x EL34's *Controls:* 1. INPUT—Mic, Radio, Tape, Gram (in conjunction with 4 position pick-up matching selector). 2. EQUALISER—6 position. 3. FILTER—6 position. 4 & 5. BASS & TREBLE (both lift & cut 15dB). 6. VOLUME.
Tape Output Socket on rear of Control Unit.

Matching VHF Tuner—FM61—£22/1/0.

Sound Value for only **£32** complete

AVAILABLE FROM LEADING HIGH FIDELITY DEALERS THROUGHOUT THE COUNTRY

Write for free descriptive literature to Dept. WWJ. ***Armstrong Amplifiers Ltd.,*** WARLTERS RD., HOLLOWAY, LONDON, N.7

RADIATION MONITORS LIMITED
Utility
GEIGER COUNTER

£10
PLUS BATTERIES

A highly sensitive, portable instrument made under licence from the U.K. Atomic Energy Authority as a general purpose monitor for the detection and qualitative measurement of gamma, x- and hard beta rays in laboratories or industrial premises.

The design employs a specially-produced low-voltage halogen-quenched geiger-mueller tube in a simple integrator circuit developed from that evolved at the Atomic Weapon Research Establishment, and provides three ranges of visual response by flashing neon, together with loudspeaker count of each ionising event at low radiation and immediate appreciation of any significant flux change at higher intensities.

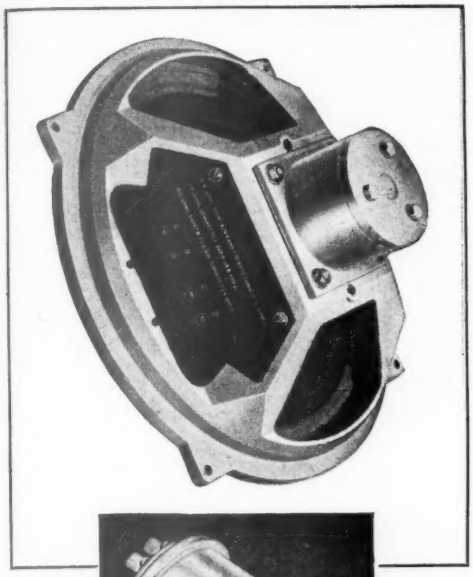
A convenient personal monitor, the Utility Counter is also suitable for radioactive survey in connection with the location of thorium or uranium ores and is ideal for realistic Civil Defence training at low radiation levels. The provision of a pulse output socket for connection to external circuit, oscilloscope or recording scaler is of particular advantage for demonstrating elementary nucleonics in schools and technical colleges.

Supplied complete with battery pack and comprehensive instruction book covering elementary nucleonics, geiger counter theory, and notes on amateur prospecting **£12/15/3.** Miniature crystal earpiece on extension lead with jack plug an optional extra.

Principal Data
Size 9 x 6 x 3 *inches. Weight* 3 *lb.*
Background count 90 *c/min.*
Operating potential 400-450 V.
Current Consumption .001 to 10*uA.*
Battery life—exceeds shelf life.
Response—exceeds 30,000 *c/m.*
Output pulses—approx. 1, 15 *and* 50 *volts.*

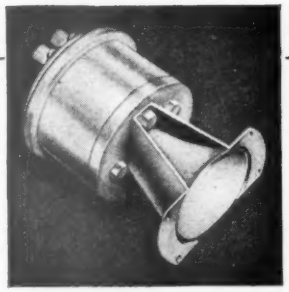
U.K. Distributors: **PROOPS BROTHERS LIMITED**
52 Tottenham Court Road, London, W.1. Tel: LANgham 0141

THE FINEST TWO-SPEAKER SYSTEM WITHIN EVERYONE'S REACH...



Thousands of Hi-Fi fans in all parts of the world have taken the trouble to write and tell us that—at just over £9—this two-speaker system is outstanding value. This is made possible only by more than thirty years' experience in sound reproduction combined with modern research and production methods in a self-contained organisation where even the smallest component is made to measure.

When housed in the cabinet described below, it forms a High Fidelity system of which anyone would be proud, both as regards its life-like reproduction and its distinguished appearance. We shall be pleased to send you fully descriptive leaflets and name of nearest stockist.



MODEL H.F.1012

10" Die-cast unit, 12,000 gauss magnet. Fitted with cambric cone, and universal impedance speech coil providing instantaneous matching at 3, 7.5 and 15 ohms. Handling capacity, 10 watts. Frequency response, 30 c.p.s.-14,000 c.p.s. Bass resonance, 35 c.p.s. (inc. P.T.) **£4·19·9**

T.10 TWEETER UNIT

Moving coil pressure type. Speech coil impedance, 15 ohms. Response, 2,000/14,000 c.p.s. Flux density, 14,000 gauss. Handling capacity, 5 watts. Dispersion angle, 90°. (inc. P.T.) **£4·4·0**

If required, a suitable cross-over network is available at 30/-

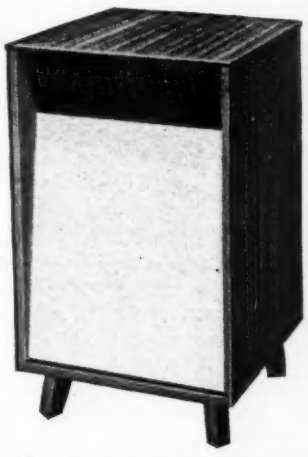
...AND A MOST ATTRACTIVE CONTEMPORARY CABINET

AUDIO FAIR

See and hear all Stentorian High Fidelity Products in Demonstration Room 306. Technical queries will be answered on Stand 3.

"Prelude" Bass Reflex Console Cabinet

This is one of our new series of contemporary style cabinets in satin-striped sapele veneers. It is supplied in ready-to-assemble form and put together in a few minutes with a screwdriver. It will provide absolute realism in reproduction when used in conjunction with Stentorian 8" or 10" units, and has provision for Tweeter unit. Size: 33" x 19" x 19½". Price: **£11·11·0**



W B Stentorian

★ *See and hear all W.B. products at our London office (109 Kingsway, W.C.2) any Saturday between 9 a.m. and 12 noon.*

WHITELEY ELECTRICAL RADIO CO. LTD · MANSFIELD · NOTTS

...and now for 230 volts

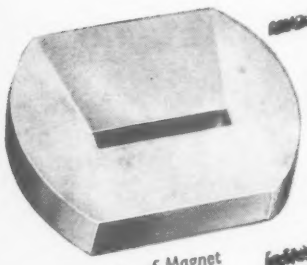
The unique construction of the 'Precision' soldering iron enables A.N.T.E.X. to offer a really small well-balanced instrument for direct operation on mains supplies, in addition to the low voltage range of 6, 12, 24 and 28V. Models are available having a consumption of 8, 12 or 15 watts, and 5 bit sizes are produced, covering from $\frac{3}{32}$" to $\frac{3}{16}$" (heavy duty).
Mains transformers are available to suit the lower voltage irons.

half size

Precision SOLDERING IRON

- Complete weight less than one ounce.
- Fully insulated elements ensure complete protection.
- Non-slip handle with thermal airgap.
- Replaceable bits are heavily nickel-plated.
- Short shaft and correct balance give precise control.
- Highly flexible light-weight lead, easily replaceable.
- Complete safety provided by earth connection with rigorous testing.
- Replaceable elements sealed in shock absorber mounting for reliability.
- Clamp on lead removes all strain from connections.

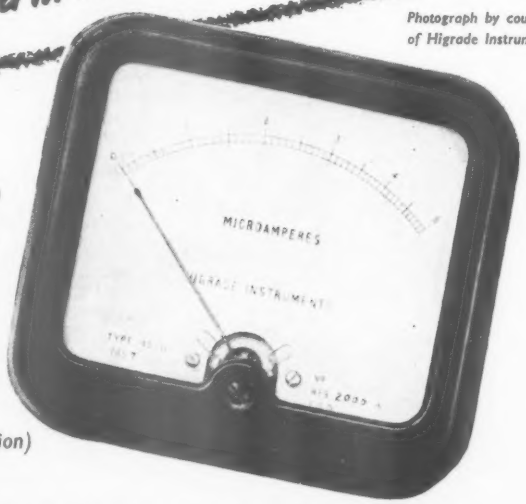
A.N.T.E.X. LTD., 3 TOWER HILL, LONDON, E.C.3
Telephone ROYAL 4439. Cables ANTEXLIM, LONDON



Actual size of Magnet

MUREX 'SINCOMAX' MAGNETS are used in 'HIGRADE' INSTRUMENTS

Photograph by courtesy of Higrade Instruments

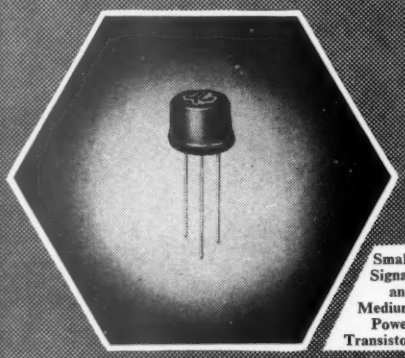


The instrument illustrated is 0/5 μA. F.S.D. with terminal resistance of 2,000 Ω. Another example of the use of Murex "Sincomax" magnets where a high energy product with high magnetic stability is essential.
Murex "Sincomax" magnets, with an alloyed bond between magnet and soft iron, continue to give accurate and reliable service in this and many other applications.

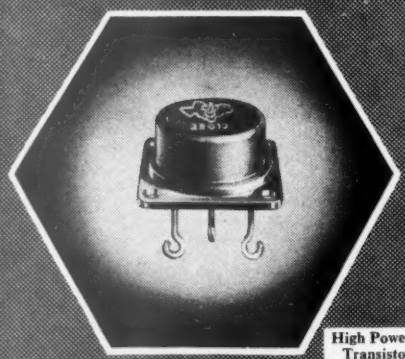
MUREX LTD. *(Powder Metallurgy Division)*
RAINHAM · ESSEX · *Rainham, Essex 3322*
Telex 28632 Telegrams: Murex, Rainham-Dagenham Telex
London Sales Office: CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.1. *Euston 8265*

HERE and NOW TEXAS

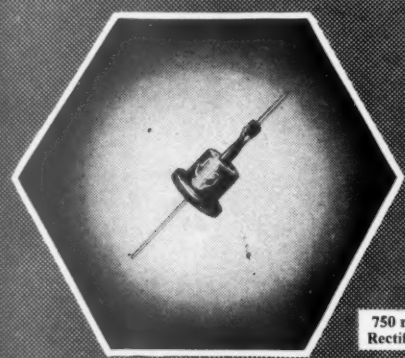
HAVE THE RANGE...



Small Signal and Medium Power Transistor



High Power Transistor



750 mA Rectifier

All illustrations are actual size

Silicon Transistors

Small Signal

This range of general purpose transistors is used for high gain, low level applications. Special features are :—negligible leakage current, a minimum alpha cut-off frequency up to 20 Mc/s, and a tetrode series providing 16 db gain at 30 Mc/s.

Medium Power

These 4-watt diffused base silicon transistors are ideally suitable for output stages in servo amplifiers. A pair in push-pull operation provide sufficient power to drive many types of servo motors. Two types are available, one with a maximum collector voltage of 60, the other of 100; the former is particularly useful for operating from 28-volt battery supplies.

High Power

Texas high-power transistors permit remarkable miniaturisation of power equipment. A collector dissipation of 37½ watts, with complete reliability, in such a small device, can only be achieved by using silicon. Furthermore, these transistors have a typical alpha cut-off frequency of 5 Mc/s.

Silicon Diodes

Medium Power Rectifiers

The new Texas diffused silicon technique has brought a fundamental change in semiconductor rectifiers. Peak inverse voltages up to 600 are featured in each of two ranges now readily available :— a metal-case rectifier provides a mean rectified current of 750 mA, and a glass-seal type provides 400 mA together with a forward to reverse current ratio of $2 \times 10^6 : 1$.

Computer Diodes

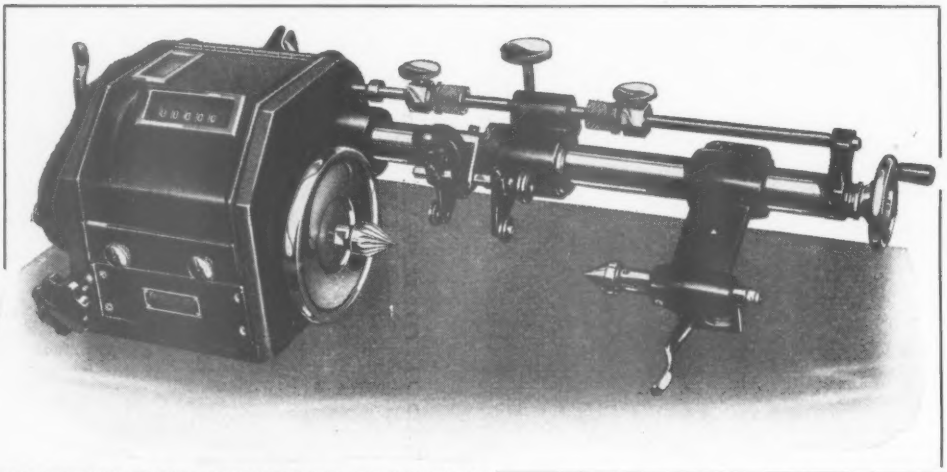
These miniature glass sealed diodes have a maximum recovery time of 0.3 micro sec with a forward current rating of 100 mA; there are three types with P.I.V. ratings of 50, 100 and 150 volts. The capacitance is 2.7 pico-farads at – 10 volts, 1 megacycle.

Complete data sheets are available on request.

TEXAS INSTRUMENTS LIMITED

DALLAS ROAD · BEDFORD · TEL: BEDFORD 68051 · CABLES TEXINLIM BEDFORD

TI TDA



AUTOMATIC COIL WINDING MACHINE

TYPE A1/1 (25/50 S.W.G.). TYPE A1/X (19/46 S.W.G.)

THE MOST OUTSTANDING MACHINE ON THE MARKET!

Dustproof construction—up to four coils can be wound simultaneously—micrometer traverse setting—easily adjusted wire gauge setting—cadmium and chromium plated steel parts—Wire Tensioning Stand of novel design holds two reels. Machines to stop automatically at a required number of turns, can now be supplied to order.

We will be pleased to send you an illustrated leaflet giving a full technical specification on request.

KOLECTRIC LTD 73 UXBRIDGE ROAD, EALING, LONDON, W.5. *EALing 8322*

Is this the answer?

P.O. TYPE 3000

The most versatile relay available today.
Coils up to 120,000Ω
Spring Set Insulation up to 5KV

Are you aware of the variety of contact build-ups we can assemble? Your problem may not be as bad as it seems if you take advantage of our wide experience in the unlimited uses of this adaptable product.

- Quotations by return
- Prototypes within 48 hours
- Good delivery guaranteed

Polarised Relays, High Speed, Contactors, A.C., P.O. Key Switches, all types Type 600 Relays Uniselectors Built to R.C.S. and R.C.L. 161 and 153 if required

RELAYS

Used all over the world for

METER PROTECTION · TIME DELAY · OVERLOAD TRIPS · ALARM SYSTEMS · FLASHING & PULSING · PROCESS CONTROL · TIMING DEVICES · MAINS FAILURE PROTECTION · COMPLEX OR SEQUENCE SWITCHING · SELECTION & COUNTING SYSTEMS · HIGH VOLTAGE SWITCHING

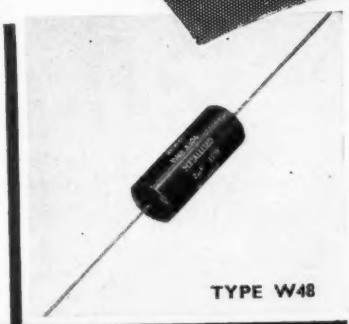
Consult the Specialists!

Jack Davis (Relays) Ltd.
(DEPT. W.) TUDOR PLACE, LONDON, W.1
TELEPHONES: MUSEUM 7960 LANGHAM 4821

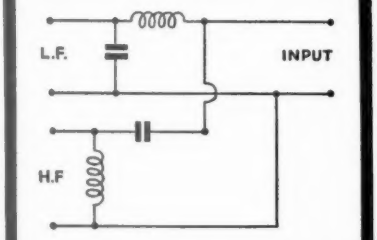
Hunts Hi-Fi CAPACITORS

FOR CROSS-OVER NETWORKS

Hunts patented Metallised Paper Capacitors are particularly suitable for loudspeaker crossover networks and are used extensively for this application. They have negligible self inductance with consequent lack of self resonance within the audio frequency range, and with the special method of end connections used on the capacitor unit, the equivalent series resistance down to zero applied volts is extremely low.
The capacitors listed below are considerably smaller in dimensions than conventional types, occupying only 25-30% of the space required for their lowest voltage counterparts in foil and paper construction.



TYPE W48



A basic circuit for a twin speaker combination is shown on the left. The number of circuit elements and their capacitance and inductance values depends on the number of loudspeakers, their individual characteristics, and the required crossover frequencies.

TYPE W54/1

STANDARD CAPACITANCE RANGE

LIST NO.	CAP μF	VOLTS D.C. Wkg.	TYPE REF.	DIMENSIONS L D	LIST PRICE
A 316	1.5	150	W48	1¾" × 11/16"	4/9
A 304	2	150	W48	1¾" × 11/16"	5/-
B 557	3	150	W49/1	1¾" × ⅞"	7/6
B 550	4	150	W49/1	2½" × 1"	10/-
B 551	6	150	W49/1	2½" × 1"	12/6
B 552	8	150	W49/1	2½" × 1⅜"	17/6
WP 45	10	150	W54/1	2½" × 1⅜"	20/-
WP 38	12	150	W54/1	2½" × 1⅜"	22/-
WP 247	16	150	W54/1	3½" × 1⅜"	26/6

TYPE W49/1

REGISTERED TRADE HUNTS MARK CAPACITORS

A. H. HUNT (Capacitors) LTD.
WANDSWORTH, LONDON, S.W.18. Tel: BATtersea 1083

Factories also in Essex, Surrey and North Wales

HYDROFLEX

seamless METAL BELLOWS

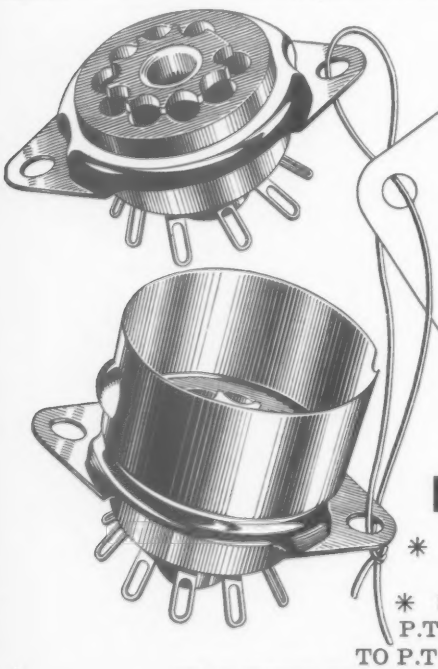
Hydroflex *seamless* metal bellows are suitable for use in temperature and pressure-sensitive systems, as vacuum or pressure seals and as shaft couplings.
They are available in a variety of materials and in a range of sizes up to 5in. outside diameter. See them on Stand 926, Instruments, Electronics and Automation Exhibition, or write for list N.800-1.

See them on

Stand 926, I.E.A.

B.19a

THE DRAYTON REGULATOR & INSTRUMENT CO. LTD., WEST DRAYTON, MIDDLESEX. *West Drayton 4012*



McMURDO

P.T.F.C.E. VALVE HOLDERS

B7G AND B9A

* LOW LOSS—**GRADE 1.**
* FULLY TROPICALISED—**CLASS H 1.**
* SILVER PLATED PHOSPHOR-BRONZE CONTACTS.

P.T.F.C.E. MOULDINGS HAVE SIMILAR PROPERTIES TO P.T.F.E. BUT THEY ARE LESS COSTLY TO PRODUCE.

FULL INTER-SERVICE TYPE APPROVAL TO Z.560092 - Z.560094 - Z.560095 - Z.560134

Send for full technical details to:—

McMURDO INSTRUMENT CO. LTD., VICTORIA WORKS, ASHTEAD, SURREY. **Telephone: ASHTEAD 3401**

MVH. 14

PERFORMANCE ASSURANCE WITH

COSSOR

PRINTED CIRCUITS

AN INSTRUMENT RANGE IN KIT FORM

Q. *Why has Cossor Instruments decided upon this innovation?*

A. To make available a range of first-class measuring instruments **at a considerable saving in cost to the Buyer.**

Q. *Are Kit instruments inferior in performance to their Factory-built equivalents?*

A. Certainly not. If assembled and wired exactly in accordance with the Manual of Instructions.

Q. *A certain skill must, surely, be required to build these instruments?*

A. None beyond the ability to use a small soldering iron.

Q. *How can a performance specification be maintained without setting up test equipment?*

A. Largely by the use of PRINTED CIRCUITS which allow no interference with the layout of critical parts of the circuit.

Q. *How many Kit instruments are at present available?*

A. Three. Two Oscilloscopes, a Single-Beam and a Double-Beam, and a Valve Voltmeter. Others will follow shortly.

Q. *Could I have more information on these interesting instruments?*

A. With the greatest of pleasure. Just write to:

Model 1071K ***Double Beam*** *Kit Oscilloscope*

List Price £69.0.0.
Hire Purchase Facilities.
Trade terms on application.

COSSOR INSTRUMENTS LIMITED

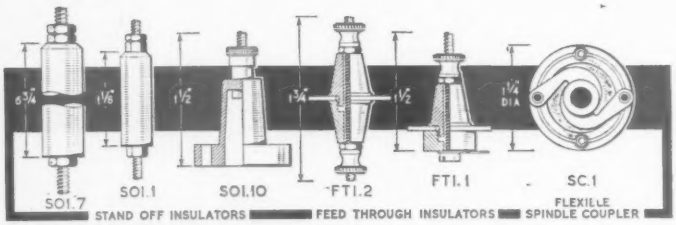
The Instrument Company of the Cossor Group

COSSOR HOUSE · HIGHBURY GROVE · LONDON, N.5

Telephone: CANonbury 1234 (33 lines) Telegrams: Cossor, Norphone, London Cables: Cossor, London

MAXI-Q INSULATORS

REGD.



STAND OFF INSULATORS, SOI.1—7. Produced from Polystyrene Rod, this range of Insulators has many uses in radio equipment, particularly for v.h.f. as the losses are negligible. One hole fixing is provided by a 6, 4 or 2BA threaded stud in the base of the insulator.

SOI.1 1¼in. × ⅜in. dia. **1/2.** SOI.2 1⅜in. × ⅜in. dia. **1/3.** SOI.3 2⅜in. × ⅜in. dia. **1/4.** SOI.4 3½ × ⅜in. dia. **1/5.** SOI.5 4 7/16 in. × ½in. dia. **1/11.** SOI.6 3in × ½in dia. **2/6.** SOI.7 6¾in. × ½in. dia. **3/-.**

STAND OFF INSULATOR, SOI.10.
This insulator is completely moulded in polythene and fixing is by two 4BA holes on ⅞in. centres. Price **1/4.**

FEED THROUGH INSULATORS, FTI.1 and FTI.2.
These moulded polystyrene components provide a sound means of feeding high voltage or r.f. leads through metal chassis, screens, etc., or alternatively, are very suitable for use as a terminal where first class insulation is required. They are most suitable where rear of panel or under-chassis space is limited.
Moulded in the following colours: Red, Blue, Green, Black and Yellow. **FTI.1 1/7. FTI.2 1/11.**

FLEXIBLE SPINDLE COUPLER, SC.I.
The lining up of components is made easy with these polythene insulated couplers. They are completely flexible but entirely free from backlash. 1½in. dia. × ⅝in. wide. The bushes are drilled for ¼in. dia. spindles. Price **2/6.**

The following Insulating Materials are available:

Polystyrene ROD: 1/16 in. dia., **1/-** per foot; ⅛in. dia. **1/4,** 3/16 in. dia., **1/9;** ¼in. dia., **2/1;** ⅜in. dia., **3/9.**

SHEET: ⅛in. thick, **½d.** per square inch; 1/16 in., **1½d.;** ⅛in., **2d.;** ¼in., **3d.**

Ebonite Rod: ⅛in. dia., **1/-** per foot; ¼in. dia. **1/9;** 5/16 in. dia., **2/3;** ⅜in. dia., **3/-.**

Ebonite Tube: ⅛in. o/d × ⅛in. i/d, **1/3** per foot.

Paxolin Tube: Square ⅛in × ⅛in. × 1/16 in. wall, **3/-** per foot. Round ⅛in. o/d × 1/16 in. i/d, **1/3** per foot; ⅛in. o/d × ⅛in. i/d, **2/7;** ⅜in. o/d × 13/32 in. i/d, **1/5;** 1in. o/d × ⅜in. i/d, **4/3;** 1¼in. o/d × 1 7/16 in. i/d, **4/3;** 1½in. o/d × 1 7/16 in. i/d, **4/9;** 1¾in. o/d × 1½in. i/d, **5/3.**

Paxolin Sheet: .024in. thick, **4/3** per square foot; ⅛in., **4/-;** 1/32 in. **7/3;** ¼in., **8/3;** ⅜in., **15/-.**

Presspahn Sheet: 1/16 in. thick, **3/-** per square foot.

Send 1/- in Stamps for GENERAL CATALOGUE. Please send S.A.E. with all enquiries. Trading terms for direct Postal Orders, C.W.O. plus appropriate postal charges.

DENCO (CLACTON) LTD., (Dept. WW) 357/9 Old Rd., Clacton-on-Sea, Essex

Stop Press: MAXI-Q PRE-SET FM TUNER, completely assembled, **£12.** VARIABLE VERSION, **£11.** COMBINED POWER PACK AND AMPLIFIER, **£5/10/-** or in comprehensive kit form **£5.**

Ferrograph

AUDIO FAIR

APRIL 18-21 · WALDORF HOTEL

We invite you to visit our Demonstration Room No. 201/2 on the first floor, at the head of the staircase, where we shall be demonstrating the following Ferrograph products:

Portable Tape Recorders • Model 66 for custom-building

Portable Stereo Recorders • Continuous Playing Deck

Defluxer, tape spools and other accessories

Technical and other queries will be answered at Stand 8 in the Main Hall

BRITISH FERROGRAPH RECORDER CO. LTD · 131 Sloane Street · London SW1
Telephone: SLOane 2214/5 and 1510

A Subsidiary of Wright and Weaire Ltd.

1000000 CYCLES PER SECOND

S.T.C. are able to offer a range of high-performance close-tolerance 1 Mc/s crystal units. The range comprises:—

STAND 156
R.E.C.M.F.
EXHIBITION
GROSVENOR HOUSE

S.T.C. TYPE	DESCRIPTION	EQUIVALENT
4044	2 pin metal containers	D E F. 5271 Style B
4046	2 pin metal containers	D E F. 5271 Style D
4013	B7G glass envelopes	D E F. 5271 Style E

The above units all meet the extreme climatic conditions laid down in RCS11

1 Mc/s CRYSTAL UNITS

As a direct replacement for the 1 Mc/s crystal unit in the popular BC221 wavemeter S.T.C. offer a unit mounted in a glass envelope with a special international octal base (service equivalent 10XAR5).

ALL UNITS {

meet the vigorous bump and vibration requirements of interservices specifications.

can be supplied to a minimum frequency tolerance of ± 0.005% over temperature range − 55°C to + 90°C.

can be manufactured for operation at either series resonant or at 30pF or 50pF input conditions.

have excellent short and long term stability.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2.

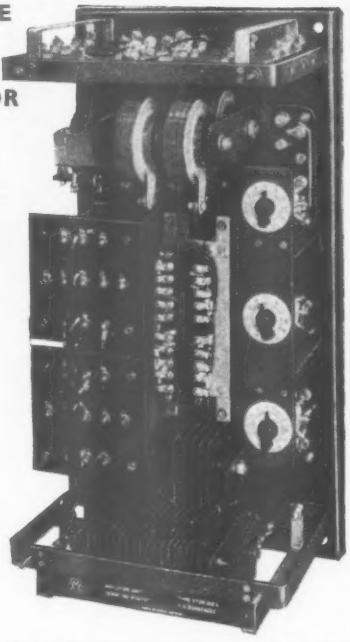
QUARTZ CRYSTAL FACTORY: HARLOW · ESSEX

THE METROPOLITAN VICKERS TYPE
VTSR/152A MAGNETIC AMPLIFIER
AUTOMATIC VOLTAGE REGULATOR
INCORPORATING

AUTOMAT.

HIGH-STABILITY SELENIUM RECTIFIERS

IMPORTANT: For the convenience of development engineers and technicians engaged on prototype units, Automat places at their disposal a service which enables small quantities of rectifiers to be designed, manufactured and despatched within forty-eight hours of receiving an enquiry.



These Metrovick Voltage Regulators are now being employed for the control of the largest turbo-generators.

AUTOMAT.

MOORSIDE · SWINTON · MANCHESTER
Telephone: SWInton 4242

CW4935

Recapture the atmosphere of the Festival Hall in your own home with Classic *HI·FI*

The expectant murmur of the crowd, mingled with the discordant wail of tuning violins. The hush as the conductor raises his baton. And then—the beauty of a Mozart symphony or a Beethoven concerto floods your room with its magnificence. No matter where you live a Hi-Fi sound system can bring the Festival Hall right into your home. A Hi-Fi gramophone or radio is an instrument refined and improved almost beyond belief. And Hi-Fi is not particularly expensive. We send sound systems and components of various kinds to all parts of the world, so write today for our fully illustrated brochure "WHAT IS HI-FI?" to

CLASSIC
ELECTRICAL COMPANY LTD.
"THE HIGH FIDELITY SPECIALISTS"

352/364 Lower Addiscombe Road, Croydon, Surrey. Telephone: ADDiscombe 6061/2. Telegrams: Classifi, Croydon, Surrey.
Bus services: 59a, 54, 12 and Green Line—725. Nearest stations: Woodside, Addiscombe, East Croydon.

It pays to use

'Cyldon'

Inductance Tuners

& VARIABLE CAPACITORS

for TELEVISION and AUTO RADIO

for Precision, Stability & Long Life

Designers and users of radio and electronic equipment know that they can rely implicitly on the efficiency and dependability of "Cyldon" Capacitors and Tuners. They know too that the exceptionally wide variety of types in the standard "Cyldon" range covers most day-to-day requirements, but that when *special* types are needed the full resources and specialised experience of the manufacturers are entirely at their disposal.

SYDNEY S. BIRD & SONS LTD.

Address for enquiries and sales correspondence:—
LONDON SALES & TECHNICAL LIAISON OFFICE,
3 PALACE MANSIONS, PALACE GARDENS, ENFIELD, MIDDX.
Telephone: Enfield 8571-3. *Telegrams: "Capacity Enfield."*
Head Office: POOLE DORSET

•

Contractors to Ministry of Supply, Post Office, and other H.M. Govt. Depts.

Equipment manufacturers are invited to write for literature covering Cyldon "Teletuners" and Cyldon Trimmers, together with details of our complete range of Variable Capacitors and list of Agents for Home and Overseas.

CABINETS FOR ANY EQUIPMENT

WE MAKE CABINETS TO YOUR SPECIFICATION

THE BUREAU

This popular bureau cabinet is veneered with the finest selected Walnut and beautifully polished in a medium shade. Designed to accommodate almost any of the many units we have available and to give generous storage compartments.

WALNUT £16 . 16 . 0
NATURAL OAK £18.18.0

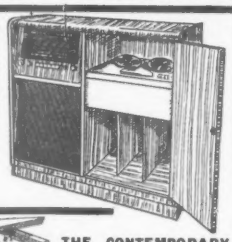
"PRELUDE"

This most attractive cabinet has been designed to utilise natural acoustic properties of the walls, and is ideal where space saving is a consideration.
Will take 8in. or 10in. speaker unit with provision for Tweeter Unit (12in. speaker cabinet also available).
Packed Flat. **£10.10.0**

THE SERENADE

Veneered with finest selected walnut, beautifully polished to a medium shade; this attractive cabinet has generous storage space, with board sliding out smoothly on metal rollers.
This cabinet can be fitted with any of the latest Hi-Fi Units.

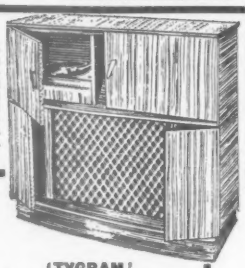
£12 . 19 . 6

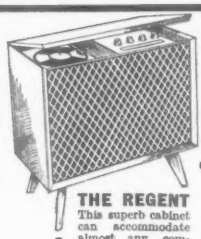


THE CONTINENTAL

This elegant Cabinet is the latest in our range designed in the continental style, solidly constructed and finished in selected mahogany veneers. Available medium, light, high gloss or contemporary finish.

£29 . 10 . 0





THE CONTEMPORARY

This beautifully made cabinet is oak veneered with mahogany interior and is waxed finished. Available in any shade to order at slightly extra cost.
This cabinet can be fitted with any of the latest Hi-Fi Units.

£10 . 15 . 0

'TYGRAM'

This smart-looking cabinet is available with or without legs. Can accommodate any type of turntable (including transcription or autochanger units).
The unit also accommodates any type of amplifier, plus most radio tuners.
9 gns.
without legs **£7 . 14 . 0**

WE ALSO CARRY A LARGE RANGE OF EQUIPMENT

See Page 122

We supply all units and can fit any cabinet with the latest Hi-Fi amplifiers, tuners, transcription units, record changers, speakers, etc., all available on easy H.P. terms. Send for our new comprehensive illustrated catalogue.

THE REGENT

This superb cabinet can accommodate almost any combination of Radio, Feeder Unit, Amplifier Control Unit, Motor Unit and Loudspeaker System. There is adequate storage space. Veneered with finest selected walnut & polished. Has a pneumatic lid and ball bearing castors.

£22 . 10 . 0

LEWIS RADIO

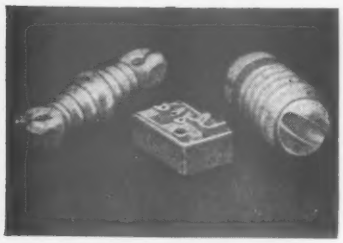
120 (Dept. 458) GREEN LANES, PALMERS GREEN (Nr. Cock) LONDON N.13. Telephone: BOWes Park 1155/6

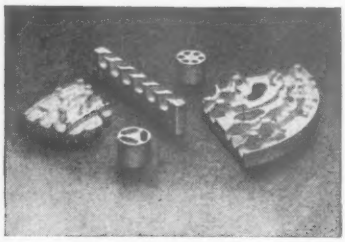
Bullers CERAMICS FOR INDUSTRY

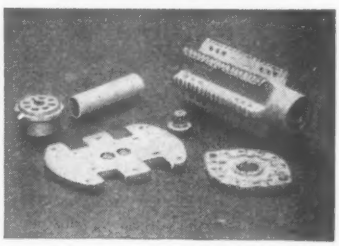
High quality material and dimensional precision are attributes of Bullers die-pressed products.

Prompt delivery at competitive prices.

See our exhibit at the Electrical Engineers Exhibition Stand No. W5.





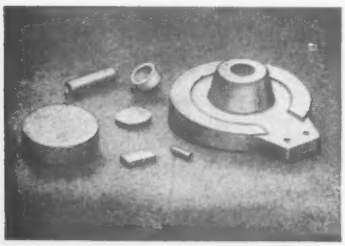


We specialise in the manufacture of—**PORCELAIN** for general insulation

REFRACTORIES for high-temperature insulation

FREQUELEX for high-frequency insulation

PERMALEX & TEMPLEX for capacitors



BULLERS LIMITED

MILTON · STOKE-ON-TRENT · STAFFS

Phone: Stoke-on-Trent 54321 (5 lines) · Telegrams & Cables: Bullers, Stoke-on-Trent

Ironworks: TIPTON, STAFFS Phone: Tipton 1691

London Office: 6 LAURENCE POUNTNEY HILL, E.C.4 Phone: MANsion House 9971

Actual size

Abridged data

Vh	= 6.3V
Vh–k (pk)	= ±250V max.
Val+a3	= 350V min.
Sx	$= \frac{95}{Va3}$ mm/V
Sy	$= \frac{110}{Va3}$ mm/V

An inexpensive waveform monitor incorporating this tube is made by BOURNE ENGINEERING LTD. Abbey Mill, St. Albans Tel : 57375

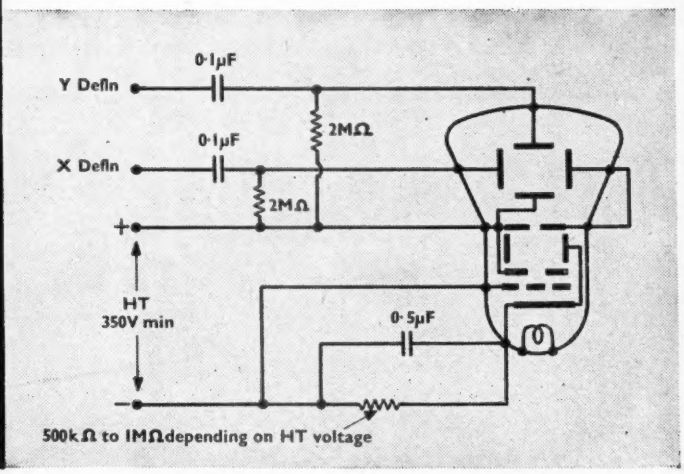
Waveform monitoring at extremely low cost with the 1CP1

Waveform monitoring facilities can be incorporated in both existing equipment and new designs with extreme ease and economy with the ETEL cathode ray tube 1CP1.

The tube itself is inexpensive and the associated circuitry required is very simple. The operating voltage is so low that in most equipment suitable connection to existing HT lines is all that is required. Beam focusing is fully automatic and auto-bias is quite adequate.

Space problems rarely occur when the 1CP1 is used—it is only 4¼ inches long and fits a normal B8G loctal socket.

If you are interested in the simplest and most economical method of waveform monitoring write to the address below for further details.



ETEL

Cathode Ray Tubes

ELECTRONIC TUBES LIMITED

Kingsmead Works · High Wycombe · Bucks · Telephone High Wycombe 2020

ETL3a

RD SENIOR

DESIGNED as the basis on which to develop a Home High Fidelity System of the most ambitious nature this entirely new amplifier will do justice to the finest complementary equipment and provide a standard of reproduction to satisfy the most exacting tastes.

Of the many unique design features which distinguish this amplifier from its contemporaries perhaps the most important is its unconditional stability under all conditions of load, including high capacity, making it particularly suitable for use with Electrostatic Loudspeakers; an essential factor to be borne in mind when choosing an amplifier to-day.

◀MK II AMPLIFIER

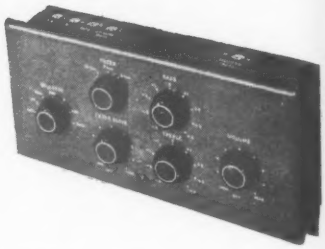
Push-pull "UL" output stage (EL34s). Nominal 20 watts, peak 36 watts. Multi-section output transformer with grain orientated laminations. Unique double cascode driver/phase-splitter circuit. Unconditional stability—particularly suitable for Electrostatic Loudspeakers. Inbuilt "Semi-High Pass" characteristic. Exceptional power/frequency response curve. Generous inductance smoothing. Ample spare power. Unique "Impedance Plug" Speaker Matching.

PRICE: **£28.0.0**

MK IV CONTROL UNIT▶

High pick-up sensitivity (8-10 m/V). Inputs for pick-up, tape, radio and microphone. Four accurate record characteristics. Tape record and replay sockets. Optional built-in tape characteristic. Switched Low Pass Filter with additional "slope" control. Wide range "Baxandall" tone controls. High and Low frequency attenuation. Low impedance cathode follower output. Styling features exclusive colour choice.

PRICE: **£13.10.0**



post free on request.

Designed for Home High Fidelity Systems

Trade and Export enquiries invited.

ROGERS DEVELOPMENTS (ELECTRONICS) LTD.

'RODEVCO WORKS' • 4-14, BARMESTON ROAD • CATFORD S.E.6 • HIT: 7424

X-band microwave measurement

PRODUCT OF N.V. PHILIPS, EINDHOVEN.

Undirectional Waveguide PP4420x.

An important new range of equipment by **PHILIPS**

This new range of Philips microwave equipment is based on years of patient research and unique practical experience in Philips own specialised laboratories and factories. Of advanced conception and design, it will enjoy a special place in the microwave field. Some special features of the range include:

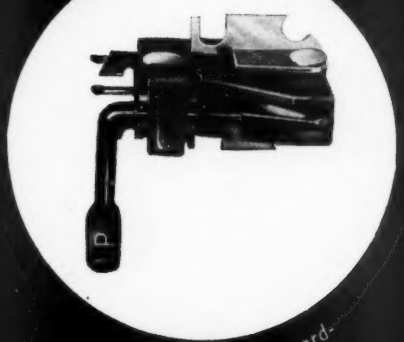
- **Unusually high technical standard—proved by many rigorous quality and life tests.**
- **Corrosion-resistant—all vulnerable parts heavily silver-plated and 'flashed' with gold.**
- **Finest quality finish. Specially developed *inexpensive* stands for all components in standard X-band waveguide.**

SEND TODAY for technical brochure giving full information on Philips microwave equipment.

PHILIPS ELECTRICAL LTD Research & Control Instruments Division
Century House · Shaftesbury Avenue · London · W.C.2

(PRC0253)

INTRODUCING THE SONOTONE 2T



All the recorded sound — that's the way the 'Sonotone' 2T equipped radiogramophone will play it! The revolutionary Sonotone pick-up head — a superior, highly sensitive product — represents another step forward in modern sound head technique by T.C.L. It is completely humidity and temperature proof, produces no magnetic hum and has a great many other technical advantages which are discussed fully in T.C.L. publication No. 1106. Design Engineers are invited to ask for a copy and for any further technical information they may require.

TCL

Technical Ceramics Limited, Wood Burcote Way, Towcester, Northants
Telephone Towcester 312

TCL.1

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the latest developments, are described fully in these new leaflets...

SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra modern equipment :—

PHOTO-FLASH EQUIPMENT • DEAF AIDS
PRIVATE TELEPHONE INSTALLATIONS
AMPLIFIERS • D.C. POWER UNITS
TRANSISTOR EQUIPMENT
MAGNETISATION EQUIPMENT
TEST GEAR

DALY
ELECTROLYTIC CAPACITORS

Condenser Specialists for over 20 years.

DALY (*Condensers*) **LTD.,** WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5. Phone: Ealing 3127-8-9. Cables: Dalcyon, London

MASTERPIECE . . .

Enthralling eloquence and emotion, the hushed tension of the dramatic moment, the rapture of the last long note . . . Mastertape alone captures the true beauty of the human voice in speech and song.

Mastertape

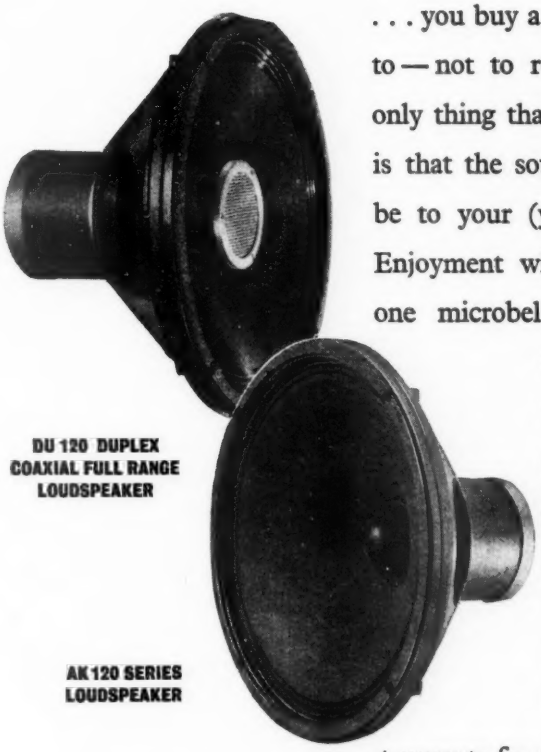
MAGNETIC RECORDING TAPE BY

MSS RECORDING CO. LTD., Colnbrook, Bucks.
Telephone: Colnbrook 2431

See us at the Audio Fair
Stand No. 19 and Room 242

Mastertape and MSS recording equipment are in regular use by many exponents and connoisseurs of fine music. Their preference proves that you too will find Mastertape a masterpiece !

When all is said and done



DU 120 DUPLEX COAXIAL FULL RANGE LOUDSPEAKER

AK 120 SERIES LOUDSPEAKER

. . . you buy a loudspeaker to listen to — not to read about — and the only thing that matters in the end is that the sound it makes should be to your (your wife's ?) liking. Enjoyment will be enhanced not one microbel by a specification which is a copy-writer's dream or by a draughtsman's delight of a response curve. It is right and proper that loudspeakers should be allowed to blow their makers' trumpets for them. Make your way to Demonstration Room 225 at the Audio Fair and let your ears judge for themselves just how good these Vitavox Loudspeakers really are.

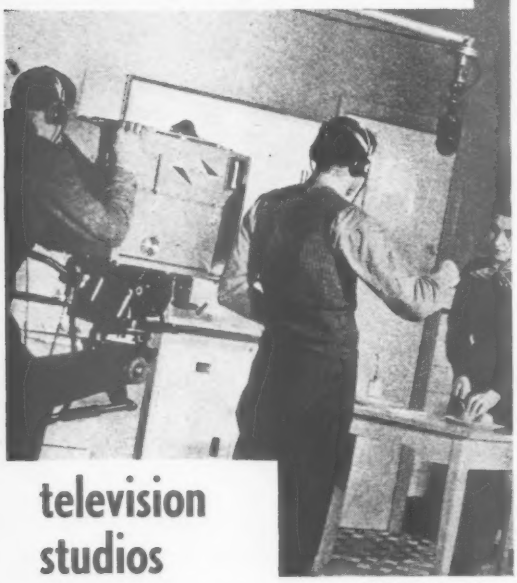
AT THE R.E.C.M.F. EXHIBITION
April 14-17, 1958
STAND No. 41

AT THE AUDIO FAIR, WALDORF HOTEL
April 18-21, 1958
BOOTH No. 31
DEMONSTRATION ROOM No. 225

VITAVOX
LOUDSPEAKERS

Vitavox Ltd., Westmoreland Road. London, N.W.9
Telephone: COL 8671

For proved performance



Photograph by courtesy of High Definition Films Ltd.

television studios are using*

S. G. BROWN Headphones

For essential studio control, television and broadcasting companies the world over choose reliable BROWN Headphones, famous for their quality of reception. All BROWN instruments are of tried and proved performance, capable of the maximum sensitivity and purity of tone.

For full details of BROWN Headphones and other equipment, write to Telephone Dept.

*** Type F**

Particularly suited to the rigours of every day use—light yet strongly made. Shockproof and highly sensitive, this general purpose instrument will give lengthy and trouble free service.

Brown

Headphones of all types. 'Automatic Helmsman' Marine Compasses. Echo Sounders. 'Navigational Equipment.'

S. G. BROWN LTD.

SHAKESPEARE STREET · WATFORD · HERTS

Telephone : Watford 7241

M. R. SUPPLIES Ltd.

(Established 1935)

Among the many facets of this unique business we are famed for rapid delivery of SMALL GEARED MOTORS of the highest grade, with a remarkable selection from stock. Variable speed series wound and capacitor/induction constant speed models. Final speeds from 840 r.p.m. down to 1 r.p.m. and final torques up to 75 lb./in. Full details are given in our List GM/357—copy sent on request.

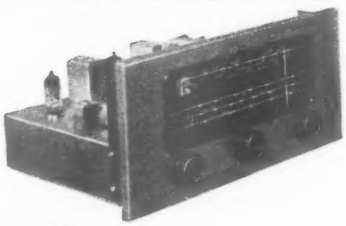
The Industrial world knows it is:

M. R. SUPPLIES, Ltd., for F. H. P. GEARED MOTORS.

ONE-QUARTER H.P. MOTORS. Made by Hoover 950 r.p.m., ⅝in. dia. shaft. Resilient mounting, split phase, 200/250 v. 50 c., 1 ph. **£5/17/6** (desp. 4/6).
MINIATURE BLOWERS. 12/24 v. D.C., 3in. L., 3in. dia. Powered by permanent magnet motor, 2in. L., 1½in. dia. **17/6** (desp. 1/6).
MODEL MOTORS. 12/24 v. A.C./D.C. 3in. L., 1½in. dia. shaft, 1in. L., ⅛in dia. A handy size suitable for boats or loco's. **10/6** (desp. 1/6).
SHADED POLE INDUCTION MOTORS. 200/250 v. A.C. Very silent running and ideal for many lab. and domestic applications, stirrers, cooling fans, extractors, etc No interference with radio/T.V. Delco super model, fan cooled, body 4½ by 3½in., shaft projection 1½in., 1,425 r.p.m., torque 600 gms/cms., and the perfect unit for tape recorders in addition to above duties, **42/6** (des. 2/6). B.T.H. Type B.P. 1304, 200/250 v. A.C., 50 c., 1,275 r.p.m., supplied with 4in. single bladed fan. Ideal for fan heaters. **39/6** (des. 2/6). Also open type, small model, body 3 by 2½in., shaft proj. approx. ½in., 2,700 r.p.m., torque 150 grm/cms. Also suitable for rim-drive gramo-motor, **18/6** (des. 2/-).
G.E.C. OUTPUT TRANSFORMERS. Tapped 2k, 4k and 8k ohms, impedence, to 2-4 ohm speech coil. Suitable for push-pull, 5 watts rating. New, in maker's carton. **8/6** (desp. 1/6).
SYNCHRONOUS TIMER MOTORS. 200/250 v. 40 c., compact units 2½ × 1⅞ × 1½in. with 1in. shaft proj. Self-starting, high torque, 6 r.p.m. Suitable also for display turntables. **57/6** (des. 1/6).
EXTRACTOR FANS. Very well-made units much below normal price, 200/250 v. A.C. induction motor, silent running, no interference. With mounting frame and back grille, ready for easy installation. With 8in. impeller, 12,000 c.ft./hr. **£5/5/-**. With 10in. impeller, 15,000 c.ft./hr. **£5/12/6** (des. either 3/6).
COMPLETE SEWING MACHINE MOTOR OUTFITS. Definitely no better job at any price. We have large sales from recommendations. 220/250 v. A.C./D.C., fitted with latest radio/T.V. suppressors, including motor with fixing brackets, foot control, needle light with switch, belt, etc., and instructions for fixing to ANY machine And we still offer the complete outfit for **£6/15/-** (des. 2/9).
PAINTON STUD-TAP POTENTIOMETERS. 500 ohms in 15 stud-taps, wire elements in screened housing, 2½in dia. by 3in. **7/6** (des. 1/6).
AIR THERMOSTATS (Kleft). Adjustable range 30/90 deg. F. Differential only 2 deg F. Capacity 15 amps. A.C. in smart ivorine housing 4½ × 2 × 2in. Easily installed—instructions with each. Ideal for greenhouse, rooms, labs., etc. **45/6** (des. 2/-).
SYNCHRONOUS TIME SWITCHES (Sangamo). 200/250 v. 50 c. In compact black plastic housing 4in. dia., by 3½in. deep, providing up to 3 on-off operations per 24 hours, with day-omitting device (use optional). Capacity 20 amps A.C. **£5/8/6** (des. 2/-). Two-circuit model (Smith's Relyon). Two 20 amp. circuits **£7/8/0.**
S.T.C. SELENIUM RECTIFIERS. 60 volts 1.5 amps. D.C **22/6.** 120 v. 1.5 amps D.C. **£2** (des. 2/-).
SENSITIVE METERS (B.P.L.). At the moment we have a very useful range of Microammeters available for delivery from stock, 0/100, 0/500, 50-0-50 microamps, various sizes, and others. Details on request.

M. R. SUPPLIES, Ltd., 68, New Oxford Street, London, W.C.1

(Telephone MUSeum 2958)



Chapman S5E/FM

This high quality De Luxe AM/FM Tuner is specially recommended to the discriminating listener. Combining superb FM quality with extreme AM sensitivity, good World Wide coverage is assured.

S5E/FM. Medium and 3 Short wavebands plus FM, with an RF stage on all AM bands and variable selectivity. Cathode Ray tuning indicator.
32½ gns. or 36½ gns. self-powered, including P.T.

S5/FM. As above, but Long, Medium and Short wavebands plus FM.

Full specifications available from

Your Hi-Fi Dealer or

C. T. CHAPMAN (Reproducers) LTD.

RILEY STREET, LONDON, S.W.10

Telephone : Flaxman 4577

SIEMENS

CONTACT COOLED SELENIUM RECTIFIERS

SIEMENS & HALSKE AKTIENGESELLSCHAFT

BERLIN · MÜNCHEN

FULL PARTICULARS FROM

R. H. COLE (OVERSEAS) LTD.

2, Caxton Street · Westminster · London S.W.1

AMPHENOL

AMPHENOL (Great Britain) **LTD.**

Invite enquiries for engineering data and details of the availability of the well known range of "AMPHENOL" products

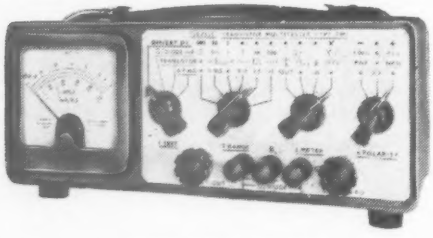
AMPHENOL (Great Britain) **LTD.**

Ormond House, 26/27, Boswell Street, London, W.C.1

Telephone : CHAncery 8956

ANNOUNCING LEVELL TYPE TMI

TRANSISTOR MULTITESTER



MEASUREMENT FEATURES

TRANSISTORS PNP AND NPN	I_{CEO} and I_{CBO}: 0/500μA and 0/5 mA f.s.d. β (i.e., α', h_{fe}') at 1 kc/s: 0/500 at any I_{CE} from 500μA to 500mA.
DIODES	Forward R: Vp at 100μA/100 mA. Reverse I: Down to 5μA at 9V.
D.C.	Resistance: 1Ω to 1MΩ Voltage: 0/5, 0/50, 0/500V f.s.d.
A.F. (150 c/s to 30 kc/s)	Current: 0/0.15, 0/1.5, 0/15 mA Voltage: 0/150 mV f.s.d. for <0.015 mA f.s.d.
OSCILLATOR	Output: 0/150 mV, 1 kc/s, sinewave, R_O<50Ω.

SIZE: 9½ x 4 x 4in. **WEIGHT:** 4 lb inc. batteries
DELIVERY: Ex stock. **PRICE:** £45. batts. 7/6 extra.

DEPT. W.,
LEVELL ELECTRONICS,
HIGH STREET, EDGWARE, MIDDLESEX. *TEL.: EDG. 5708*

All good 'labs' use
Radiospares
quality components
for design
development and
prototype work

Service Engineers!

Remember- Radiospares components are delivered absolutely "by return"

LOUD-SPEAKER MANUFACTURERS

FOR THE RADIO INDUSTRY SINCE 1930

REPRODUCERS AND AMPLIFIERS LTD.

WOLVERHAMPTON · ENGLAND

TELEPHONE : 22241/2/3/4 CABLES : AUDIO

· PHILIPS · PORTADYNE · PYE · R.G.D. · RAYMOND · REDIFFUSION · REGENTONE · SOBELL · ULTRA · VIDOR · ALBA · BUSH · COSSOR · DYNATRON · EKCO · FERGUSON · PHILCO · PETO SCOTT · MURPHY · MASTERADIO · FERRANTI · ARGOSY · BUSH · COSSOR · DYNATRON · EKCO · FERGUSON ·

EGEN ELECTRIC supply

OVER 10,000,000

components—variable, preset,

fixed, standard, miniature,

sub-miniature potentiometers etc

EVERY YEAR to the leading

radio and T/V manufacturers

in GREAT BRITAIN

EGEN ELECTRIC LIMITED

CHARFLEET INDUSTRIAL ESTATE

CANVEY ISLAND · ESSEX · Tel: Canvey Island 691/2

· MURPHY · MASTERADIO · FERRANTI ·

WALMORE ELECTRONICS LIMITED

PHOENIX HOUSE, 19/23 OXFORD STREET LONDON, W.1

Telephone: GERrard 0522 *Cables: Valvexpor*
For immediate response Telex London 8752

EXPORTERS OF **RADIO, TELEVISION** AND **INDUSTRIAL TUBES,** HAVE PLEASURE IN INTRODUCING THEIR BRAND

RADIO **WALRAD** TUBE

AND INVITE ENQUIRIES FROM BUYING AND CONFIRMING HOUSES **EXCLUSIVELY FOR EXPORT**

SUPPLIERS OF RADIO COMPONENTS ELECTROLYTICS, AND CATHODE RAY TUBES

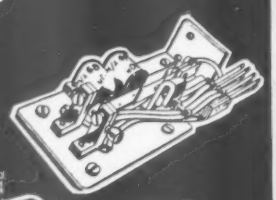
RELAYS

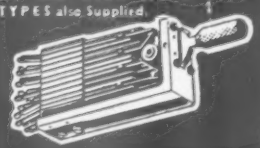
P.O. TYPES MANUFACTURED TO YOUR SPECIFICATION

PROMPT DELIVERY

3000 TYPES

COILS up to 80,000Ω.
CONTACTS up to 8 c/o's
Tropicalizing and impregnating to order.
600 and HIGH-SPEED TYPES also Supplied.





LARGE STOCKS OF KEYSWITCHES

THE KEYSWITCH CO.

ALL POST OFFICE EQUIPMENT

Enquiries to Sales Manager

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666, 4640 *Grams: "Fonequipt", London, W.10*
Contractors to Home & Overseas Governments & H.M. Crown Agents

Q.U.A.D. F.M. TUNER

- HIGH-QUALITY REPRODUCTION
- UNIQUE TUNING INDICATOR
- NO DRIFT
- PRICE £30/9/-

Also available
Q.U.A.D. II AMPLIFIER

GARRARD 301

TRANSCRIPTION MOTOR £26/8/3

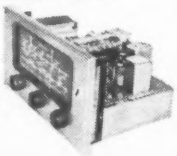
(WITH "STROBE" TABLE £28/0/11)

CHAPMAN FM 85

AM/FM TUNER

High quality VHF. Drift free with Medium and Long wavebands. £25/4/-

(Self powered 4 gns. extra.)



B.J. TANGENTIAL ARM & ACCESSORIES

IN STOCK

SUB-MINIATURE TRANSISTOR COMPONENTS

TRANSFORMERS
I.F.'s, etc.

(Full list in our catalogue.)

WELWYN & "LAB"

PRECISION RESISTORS AND T.C.C. CLOSE TOLERANCE CONDENSERS

ELCOM MULTI PLUGS

4-WAY PLUG AND SOCKET...	8/6
6-WAY DITTO.....	9/6
8-WAY DITTO.....	11/-

ARMSTRONG PB409

AM/FM RADIOGRAM CHASSIS £29.8.0

HIRE PURCHASE AVAILABLE OVER £10

HAVE YOU HAD OUR 1958 (40 PAGE) FULLY ILLUSTRATED CATALOGUE

6d. POST FREE

LEAK TL/12 PLUS AMPLIFIER & VARISLOPE III PRE AMPLIFIER

AMPLIFIER £18/18/- VARISLOPE III £15/15/-

Also available

POINT ONE "PLUS" PRE-AMP £10 10 0

DYNAMIC PICK-UP (Diamond L.P. and TRANS.) £13 16 5

IN OUR DEMONSTRATION ROOMS YOU CAN HAVE "Side-by-Side" COMPARISON

OF

AMPLIFIERS & RADIO UNITS

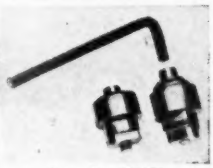
BY

- ACOUSTICAL
- ARMSTRONG
- CHAPMAN
- DYNATRON
- LEAK
- RCA
- ROGERS
- SOUND SALES
- TANNOY, etc.

WITH THE LATEST GRAMOPHONE UNITS AND SPEAKER ASSEMBLIES

"Q-MAX" CHASSIS CUTTERS

The easiest and quickest way of cutting holes in SHEET METAL.



Patent No. 619178

		each
⅛in.	(a)	12/9
¼in. or ⅜in.	(a)	13/9
½in. or ⅝in	(b)	16/-
¾in.	(b)	16/-
⅞in.	(b)	18/-
1in.	(b)	18/-
1¼in.	(b)	20/6
2⅜in.	(c)	33/6
2½in.	(c)	38/6
1in. square.....	(b)	25/6

Keys (a) 1/-. (b) 1/6. (c) 2/3.

"Q-MAX" GRID DIP OSCILLATOR

with eight coils from 1.5 to 300 Mcs. 15 gns.

ALL COMPONENTS FOR

Osram 912 plus Mullard 3 7, 10 and 20 watt and Williamson Amplifiers (S.A.E. for special lists)

BERRY'S RADIO

25 HIGH HOLBORN, LONDON, W.C.1

Telephone: HOLborn 6231-2

(OPPOSITE CHANCERY LANE)

HI-FI SPEAKERS ENCLOSURES CROSSOVERS etc.

- DYNATRON
- G.E.C.
- PHILIPS
- TANNOY
- WHARFEDALE
- W.B., etc., on demonstration.

GOODMANS "SHERWOOD"

Fitted Axiom 150 Mk. II and Resistance Unit 172 ARU. £31/4/9

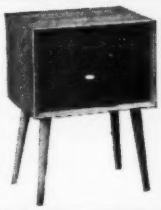
UNIT CABINETS

(20 x 14 x 14½in.)

Gram.	£5 19 6
Speaker	£5 17 6
Record...	£4 17 6

(legs extra)

also Gram. Unit (20½ x 16½ x 17in.) (Full height on legs 29in.) £9/9/-



CHAIRSIDE CABINETS FOR LEAK & Q.U.A.D.

COLLARO 4T200

Transcription Unit (PX) £19/10/- (less pick-up £14/18/-)

ALL THE LEADING TAPE REPRODUCERS, TAPES, etc. IN STOCK

PICK-UPS

BY

- ACOS
- B.J.
- COLLARO
- CONNOISSEUR
- ELAC
- GOLDRING
- TANNOY, etc.

COMPLETE RANGE OF

- GILSON
- WODEN
- PARTRIDGE

TRANSFORMERS & CHOKES

ROGERS JUNIOR

MARK II AMPLIFIER AND CONTROL UNIT £28

EXPORTS TO ANY PART OF THE WORLD

Another "*Winner*" for Garrard

The Garrard Model RC.121/Mk. II Record Changer will play automatically any number of records, up to 10 either 7", 8", 9", 10" or 12" diameter at 16⅔, 33⅓, 45 or 78 r.p.m. 10" and 12" records of the same speed can be mixed in any order. No setting for any record size required, the selection being completely automatic. 7" 45 r.p.m. records with large centre hole may be played using the large record spindle Type LRS4 (available as an optional extra) or centre hole clip-in adaptors available at record stores.

Records may also be played manually and the changer stopped and started if desired without rejecting the record being played.

An illustrated catalogue of the whole Garrard range is available on request.

Garrard

AUDIO PERFECTION

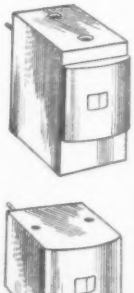
THE GARRARD ENGINEERING AND MANUFACTURING CO. LTD.

SWINDON · WILTSHIRE

SPUTNIK

The very word Sputnik conjures up ideas of great scientific developments in the near future . . . magnetic recording will play its part in these developments and we shall aim to supply recording heads for every application that arises.

TYPE E. Standard head for ¼in. Tape (¼ track). Front $\frac{7}{16}$in. square and curved 1¼in. radius. Body ¾in. diameter. Overall length (less tags), ¾in. Tags protrude at rear. Medium impedance 190 mH. or High impedance 450 mH. Price 46/- each. STOCK.



TYPE FR. Head type E in holder type F. Holder size: Height ¾in., width $\frac{7}{16}$in., length ¾in. Two 6 B.A. tapped holes ¼in. apart for fixing and head clamping. Alternative ways up of fixing allow for upper or lower track recording. (Bottom of tape ¼in. above fixing base.) Price 50/6 each. complete. Stock.

TYPE DR. Similar to type E but with larger body to allow for fixing holes. ¾in. square, curved 1¼in. radius on front. Overall length (less tags) ¾in. Tags protrude at rear. 10 BA. Fixing holes. Price 52/6 each.

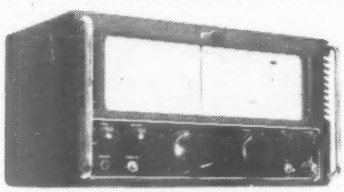
SEND FOR LISTS.

TRADE ENQUIRIES INVITED.

P. A. MARRIOTT & CO.

Sunleigh Works, Sunleigh Road Alperton, Middlesex. *Phone: Wembley 7493.*

EDDYSTONE COMMUNICATION RECEIVERS



Model 840A illustrated

Cash Prices and Statutory Terms

Model	Cash Price	Deposit	8 Monthly Payments of
820	£31 18 0	£3 14 6	£3 14 6
870	£34 16 0	£4 1 6	£4 1 6
840A	£55 0 0	£6 8 4	£6 8 4
750	£78 0 0	£9 2 0	£9 2 0
888	£110 0 0	£12 16 8	£12 16 8
680X	£120 0 0	£14 0 0	£14 0 0

Cash price if paid in 6 months by Bankers' order.

Carriage paid per passenger train.

Model 840A is for A.C. or D.C. 110/250 v.; 750 and 680X 110/240 v. A.C. These sets are the choice of the discerning professional and amateur users. Descriptive literature gladly forwarded.

Latest EDDYSTONE Component Catalogue 1/-.

HP RADIO

The Eddystone Specialists

SERVICES LTD.

55 COUNTY ROAD, LIVERPOOL, 4

Telephone: AINTREE 1445 ESTAB. 1935

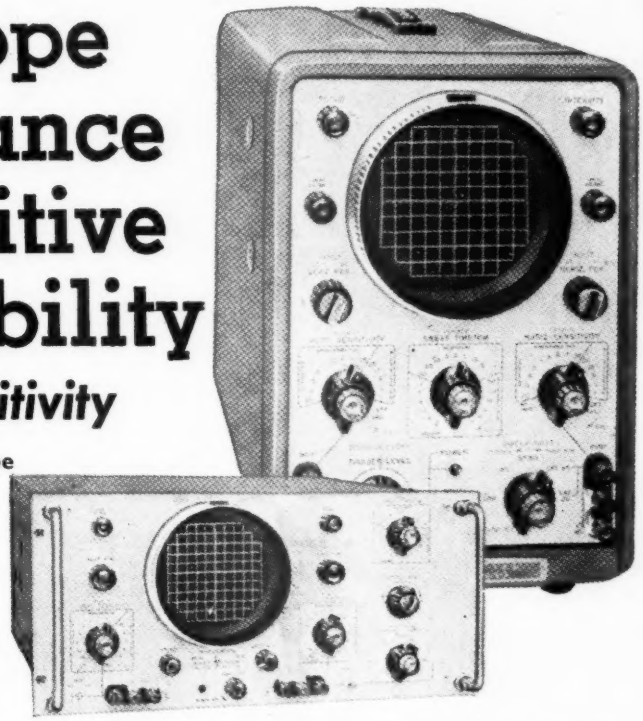
CALL US ON TELEX. 62-244.

Yours for £267

Delivered in U.K. Plus duty if applicable.

Big scope performance and positive dependability

...with 1 mv sensitivity



-hp- 130A Low Frequency Oscilloscope

Few, simple controls
Immediate delivery
Direct reading
"Universal" automatic trigger.
No preamplification with most transducers
Similar X and Y amplifiers
High stability, accuracy

We have been told, and we frankly believe, that the 130A is the best low frequency oscilloscope offered. Certainly, the best value.

But seeing is believing. Call your -*hp*- rep now, and ask him to bring over a 130A. Wring it out on your own problems, on your own bench.

See if you don't find it vastly simpler to use. Faster. More sure. Steady, dependable, versatile.

Note the "universal" automatic trigger arrangement which virtually eliminates resetting regardless of input. And the bright, rock-solid trace, generally without preamplification between scope and transducer.

Wouldn't this oscilloscope mean real time-savings and simplification to you? Call about it now!

HEWLETT-PACKARD COMPANY
Represented by
LIVINGSTON LABORATORIES LTD.
RETCAR STREET, LONDON, N.19, ENGLAND
Tel.: Archway 6251

SPECIFICATIONS 130A

Input Amplifiers: (Similar Vert. and Horiz. Amps) Sensitivity 1 mv/cm to 50 v/cm.; 14 calibrated ranges 1-2-5-10 sequence plus continuous vernier. Pass band dc to 300 KC; ac or dc coupling. Balanced input on 1, 2, 5, 10 and 20 mc/cm ranges. Direct reading.

Sweep Range: 1μsec/cm to 12.5 sec/cm. 21 sweeps, 1-2-5-10 sequence. Direct reading, 5% accuracy.

Triggering: Internal, line voltage or external 0.5 v or more. Pos. or neg. slope, + 30 to − 30 v trigger range.

Preset Trigger: Optimum setting for automatic stable triggering.

Amplitude Calibration: 1 Kc square wave, 2% accuracy.

Price: £267 delivered in U.K. plus duty if applicable.

Data subject to change without notice.
Prices f.o.b. factory.

hp complete line of high quality oscilloscopes

PREMIER

207, EDGWARE ROAD, LONDON, W.2. Tel: AMB 4033 & PAD 3271 YOUR LEADING DO-IT-

THE "Petite" PORTABLE

MAY BE BUILT FOR

£7-7-0

plus 3/- post & packing.

Batteries extra.
HT 10/- (Type B126) or equivalent.
LT 1/6 (Type AD 35) or equivalent.

- ★ Size only 8in. x 8in. x 4½in.
- ★ Weight, including batteries, 5½lb.
- ★ 4 valves of the economy type.
- ★ Medium and long wave superhet circuit
- ★ High Q frame aerials.
- ★ High sensitivity on both wavebands
- ★ Prealigned IF transformers.
- ★ 5in. speaker of the latest type.
- ★ Automatic on/off switch operated by lid.
- ★ Designed in our own laboratory.
- ★ Backed by an up-to-date Technical Information Dept.
- ★ Components available separately if desired
- ★ Simple to construct, using normal soldering methods.
- ★ Instruction book 1/6.

Mains unit now available for only 37/6 plus 2/- pkg. & carr. Send for leaflet.

SAVE POUNDS AND PUT IT TOGETHER YOURSELF!

TOTAL COST ONLY **£9-19-6**

plus 5/- packing & postage.

Each Unit may be purchased separately as follows:—

Amplifier Cabinet in maroon and fawn (size 13¾ × 11 × 6¼in.)	£2/10/-
1 Valve Amplifier	£2/19/6
7 × 4in. Elliptical Speaker	£1/1/6
B.S.R. TU8 Turntable and Pickup	£3/19/6

This can also be supplied complete with the **Latest Collaro 4-speed Junior Turntable and Pickup** for only £10/12/6 plus 5/- packing and postage.

If any of the individual items are purchased kindly add the postage as follows: Cabinet 3/-, Amplifier and Speaker 3/-, Turntable 2/6.

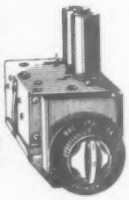
STIRLING VHF/FM TUNER UNIT

A cleverly designed Unit suitable for installation either in existing equipment or as an external Unit. Completely self contained with its own power supply. The latest type permeability tuned circuit is used, tuning drift being negligible. Size 7½ × 7½ × 2½in. Cash Price £13/13/-. Postage and packing 2/6 extra. Cr. Terms £1/15/- deposit and 8 monthly payments of £1/13/6. Plus postage and packing of 2/6.

WHY BUY SURPLUS OR RE-CONDITIONED TUBES WHEN THESE FULLY GUARANTEED WIDE ANGLE TUBES ARE AVAILABLE? THE LATEST TYPE 17in. RECTANGULAR TUBE AT £17 (INCL. TAX), POST AND PACKING 21/- EXTRA. ALSO 14in. RECTANGULAR TUBE TYPE 14LPA £13/19/6 (INCL. TAX) PACKING AND CARRIAGE 15/- EXTRA.

Build the NEW "MAYFAIR" TELEVISOR

which gives complete SAFETY to the constructor!



These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

★ B.B.C. & I.T.A. DESIGN

WITH NEW TURRET TUNER MAY BE BUILT FOR £33-7-11

PLUS COST OF C.R.T.

Build in 5 Easy Stages. Full Construction details available. Instruction Book 3/6 Post Free.

CONSOLE CABINETS with full length doors for 14in., 16in. and 17in. tubes. PRICE £14/14/-. H.P. Terms: Deposit £7/7/6 and 9 monthly payments of 18/6. **CONSOLE CABINETS.** Half-door £12/12/-. H.P. Terms: Deposit £6/6/- and 8 monthly payments of 18/3. On above cabinets add 21/- for pkg. and carr.

PLEASE ADDRESS ALL MAIL ORDER ENQUIRIES TO

RADIO CO

YOURSELF SPECIALISTS 23 TOTTENHAM COURT RD., LONDON. W.1. Tel: MUSeum 3451

Build this New TAPE RECORDER KIT

for only **£38.15.0**

This Kit comprises:

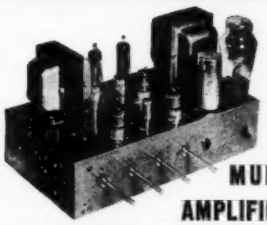
2-speed lane Mk. VI Deck..... £18/10/-
Premier Tape Amplifier complete with separate plug-in-type power pack..... £14/0/-
7 × 4 Elliptical Speaker £1/1/6
De-luxe Cabinet with gilt fittings and detachable lid £4/19/6
Reel of Scotch Boy 1,200ft. Tape and empty Spool £1/11/6
Latest Type ACOS microphone .. £2/15/-
All the above sections can be purchased separately.

The New De-Luxe TAPE RECORDER TR3

for £6/5/- DEPOSIT AND 8 MONTHLY PAYMENTS of £3/17/11 OR CASH 45 gns. plus 21/- post and pkg.

Case finished in Red and Cream with Gilt styling and fittings. Size 18½ × 15 × 9in. For A.C. mains 200/250 v. 50 cycles. Complete with tape and latest Acos microphone 2-speed twin track giving 1 or 2 hours recording respectively, incorporating a 10 × 6in. high flux loudspeaker.

THE PREMIER 2-valve Printed Circuit 3-Watt Gram Amplifier using a Mullard UY85 and a Mullard UCL83. Supplied completely assembled and tested for only **£3/5/6** plus 2/6 packing and postage.



Why not make the best!

MULLARD AMPLIFIER KIT

NOW SUPPLIED WITH ULTRALINEAR OUTPUT TRANSFORMER.
All the components for model 510, PLUS pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for **£12/12/-** plus pkg. and post 7/6. This version complete and tested **£15/15/-**. Or pre-amplifier and tone control in a separate unit **£14/14/-** plus pkg. and post 7/6.

Visit

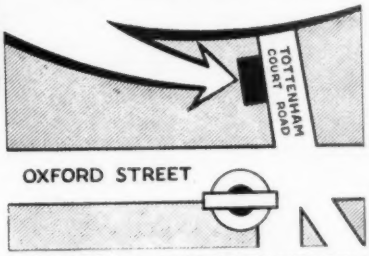
OUR NEW HI-FI SHOWROOM AT

23 TOTTENHAM COURT RD.

The best Hi-Fi Showroom in the district!

(2 Mins. from Tottenham Court Rd. Underground Stn.)

TEL: MUSEUM 3451



COMPACT GRAM AMPLIFIER

Complete ready to connect to any type of Pick-up and Speaker (3 ohms) A.C. Mains 200/250v. Volume and tone control on 9in. extended leads. 1 valve. Overall size 7in. long × 6in. wide × 3¼in. high. Suitable speaker for above 7in. × 4in. elliptical **21/10**.

Price £2.19.6

Plus pkg. & post 2/6

CABINETS—PORTABLE

MODEL PC/2
Grey Lizard Rexine covered 45/-
Overall dimensions 15in. × 13½in. × 6¾in. Clearance under lid when closed 3in.

MODEL PC/2 DE LUXE
Two colours, wine and grey, with cut-out for speaker and amplifier 55/6
Dimensions 15in.× 14in. × 7¼in.

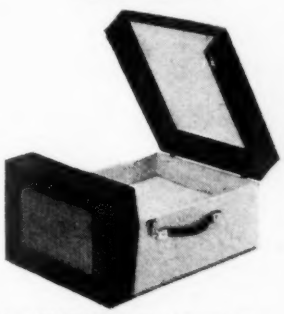
MODEL PC/3
Grey Lizard Rexine covered 69/6
Overall dimensions 16¾in. × 14½in. × 11in.
Clearance under lid when closed 3¼in.

MODEL PC/3 DE LUXE
As above but with cutouts for Speaker and Amplifier 79/6
Dimensions as above

THE ABOVE CABINETS ARE COMPLETE WITH CARRYING HANDLE, FASTENERS AND PANEL.
Packing and Postage 3/- each.

Junction Transistors 10/- each
Equivalent of the OC70 Type

SAVE POUNDS AND PUT IT TOGETHER YOURSELF!



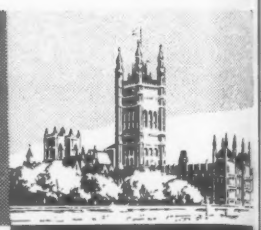
Cabinet **£2/19/6**, plus 5/- *pkg. and post.*
Premier 1 valve Gram. Amplifier **£2/19/6**, plus 2/6 *pkg. and post.*
Premier 2 Valve Printed Circuit Amplifier **£3/5/6**, *plus* 2/6 *pkg. and post.*
8in. × 5in. Speaker **27/6**, *plus* 1/6 *pkg. and post.*
Collaro 4-Speed Changer **£8/19/6**, *plus* 5/- *pkg. and post.*
BSR 4-Speed Changer **£8/15/-**, *plus* 5/- *pkg. and post.*
If a set of parts is purchased together pkg. and post will be 10/-.

SEND 3d. STAMP FOR OUR LATEST CATALOGUE

We carry a comprehensive stock of components by all leading manufacturers.

(Dept. WW) 207 EDGWARE ROAD · LONDON W.2.

PREMIER



207, EDGWARE ROAD, LONDON, W.2. Tel: AMB 4033 & PAD 3271 YOUR LEADING DO-IT-

THE "Petite" PORTABLE

MAY BE BUILT FOR

£7-7-0

plus 3/- post & packing.

Batteries extra.
HT 10/- (Type B126) or equivalent.
LT 1/6 (Type AD 35) or equivalent.

- ★ Size only 8in. x 8in. x 4¼in.
- ★ Weight, including batteries, 5½lb.
- ★ 4 valves of the economy type.
- ★ Medium and long wave superhet circuit.
- ★ High Q frame aerials.
- ★ High sensitivity on both wavebands.
- ★ Prealigned IF transformers.
- ★ 5in. speaker of the latest type.
- ★ Automatic on/off switch operated by lid.
- ★ Designed in our own laboratory.
- ★ Backed by an up-to-date Technical Information Dept.
- ★ Components available separately if desired.
- ★ Simple to construct, using normal soldering methods.
- ★ Instruction book 1/6.

Mains unit now available for only 37/6 plus 2/- pkg. & carr. Send for leaflet.

SAVE POUNDS AND PUT IT TOGETHER YOURSELF!

TOTAL COST ONLY £9-19-6

plus 5/- packing & postage.

Each Unit may be purchased separately as follows:—

Amplifier Cabinet in maroon and fawn (size 13¾ × 11 × 6½in.)	£2/10/-
1 Valve Amplifier	£2/19/6
7 × 4in. Elliptical Speaker	£1/1/6
B.S.R. TU8 Turntable and Pickup	£3/19/6

This can also be supplied complete with the **Latest Collaro 4-speed Junior Turntable and Pickup** for only £10/12/6 plus 5/- packing and postage.

If any of the individual items are purchased kindly add the postage as follows: Cabinet 3/-, Amplifier and Speaker 3/-, Turntable 2/6.

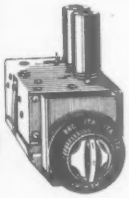
STIRLING VHF/FM TUNER UNIT

A cleverly designed Unit suitable for installation either in existing equipment or as an external Unit. Completely self contained with its own power supply. The latest type permeability tuned circuit is used, tuning drift being negligible. Size 7½ × 7½ × 2¾in. Cash Price £13/13/-. Postage and packing 2/6 extra. Cr. Terms £1/15/- deposit and 8 monthly payments of £1/13/6. Plus postage and packing of 2/6.

WHY BUY SURPLUS OR RE-CONDITIONED TUBES WHEN THESE FULLY GUARANTEED WIDE ANGLE TUBES ARE AVAILABLE? THE LATEST TYPE 17in. RECTANGULAR TUBE AT £17 (INCL. TAX), POST AND PACKING 21/- EXTRA. ALSO 14in. RECTANGULAR TUBE TYPE 14LPA £13/10/6 (INCL. TAX) PACKING AND CARRIAGE 15/- EXTRA.

Build the NEW "MAYFAIR" TELEVISOR

which gives complete SAFETY to the constructor!



These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

★ B.B.C. & I.T.A. DESIGN

WITH NEW TURRET TUNER MAY BE BUILT FOR £33-7-11
PLUS COST OF C.R.T.

Build in 5 Easy Stages. Full Construction details available. Instruction Book 3/6 Post Free.

CONSOLE CABINETS with full length doors for 14in., 16in. and 17in. tubes. PRICE £14/14/-. H.P. Terms: Deposit £7/7/6 and 9 monthly payments of 18/6.
CONSOLE CABINETS. Half-door £12/12/-. H.P. Terms: Deposit £6/6/- and 8 monthly payments of 18/3. On above cabinets add 21/- for pkg. and carr.

PLEASE ADDRESS ALL MAIL ORDER ENQUIRIES TO

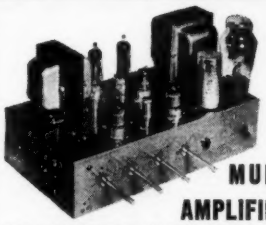
RADIO CO

YOURSELF SPECIALISTS 23 TOTTENHAM COURT RD., LONDON. W.1. Tel: MUSeum 3451

Build this New
TAPE RECORDER KIT

for only
£38.15.0

This Kit comprises:
2-speed lane Mk. VI Deck..... £18/10/-
Premier Tape Amplifier complete with separate plug-in-type power pack..... £14/0/-
7 × 4 Elliptical Speaker £1/1/6
De-luxe Cabinet with gilt fittings and detachable lid £4/19/6
Reel of Scotch Boy 1,200ft. Tape and empty Spool £1/11/6
Latest Type ACOS microphone .. £2/15/-
All the above sections can be purchased separately.



Why not make the best!
MULLARD AMPLIFIER KIT

NOW SUPPLIED WITH ULTRALINEAR OUTPUT TRANSFORMER.
All the components for model 510, PLUS pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for £12/12/- plus pkg. and post 7/6. This version complete and tested £15/15/-. Or pre-amplifier and tone control in a separate unit £14/14/- plus pkg. and post 7/6.

CABINETS—PORTABLE

MODEL PC/2
Grey Lizard Rexine covered 45/-
Overall dimensions 15in. × 13½in. × 6¾in. Clearance under lid when closed 3in.
MODEL PC/2 DE LUXE
Two colours, wine and grey, with cut-out for speaker and amplifier 55/6
Dimensions 15in. × 14in. × 7¼in.
MODEL PC/3
Grey Lizard Rexine covered 69/6
Overall dimensions 16½in. × 14½in. × 11in. Clearance under lid when closed 3½in.
MODEL PC/3 DE LUXE
As above but with cutouts for Speaker and Amplifier 79/6
Dimensions as above
THE ABOVE CABINETS ARE COMPLETE WITH CARRYING HANDLE, FASTENERS AND PANEL.
Packing and Postage 3/- each.

Junction Transistors 10/- each
Equivalent of the OC70 Type

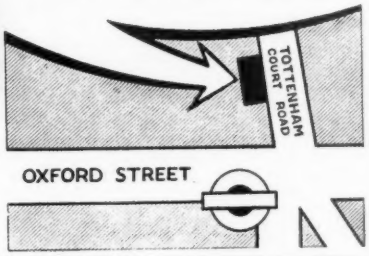
The New De-Luxe
TAPE RECORDER TR3

for £6/5/- DEPOSIT AND 8 MONTHLY PAYMENTS of £5/17/11 OR CASH
45 gns. plus 21/- post and pkg.

Case finished in Red and Cream with Gilt styling and fittings. Size 18½ × 15 × 9in. For A.C. mains 200/250 v. 50 cycles. Complete with tape and latest Acos microphone 2-speed twin track giving 1 or 2 hours recording respectively, incorporating a 10 × 6in. high flux loudspeaker.

THE PREMIER 2-valve Printed Circuit 3-Watt Gram Amplifier using a Mullard UY85 and a Mullard UCL83. Supplied completely assembled and tested for only £3/5/6 plus 2/6 packing and postage.

Visit
OUR NEW HI-FI SHOWROOM
AT
23 TOTTENHAM COURT RD.
The best Hi-Fi Showroom in the district!
(2 Mins. from Tottenham Court Rd. Underground Stn.)
TEL: MUSEUM 3451

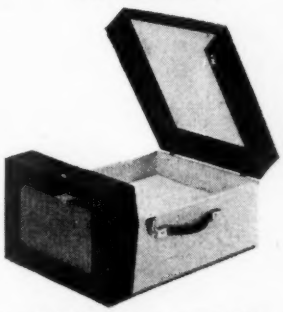


COMPACT GRAM AMPLIFIER

Complete ready to connect to any type of Pick-up and Speaker (3 ohms) A.C. Mains 200/250v. Volume and tone control on 9in. extended leads. 1 valve. Overall size 7in. long × 6in. wide × 3¼in. high. Suitable speaker for above 7in. × 4in. elliptical 21/10.

Price £2.19.6
Plus pkg. & post 2/6

SAVE POUNDS AND PUT IT TOGETHER YOURSELF!



Cabinet £2/19/6, plus 5/- *pkg. and post.*
Premier 1 valve Gram. Amplifier £2/19/6, plus 2/6 *pkg. and post.*
Premier 2 Valve Printed Circuit Amplifier £3/5/6, *plus* 2/6 *pkg. and post.*
8in. × 5in. Speaker 27/6, *plus* 1/6 *pkg. and post.*
Collaro 4-Speed Changer £8/19/6, *plus* 5/- *pkg. and post.*
BSR 4-Speed Changer £8/15/-, *plus* 5/- *pkg. and post.*
If a set of parts is purchased together pkg. and post will be 10/-.

SEND 3d. STAMP FOR OUR LATEST CATALOGUE

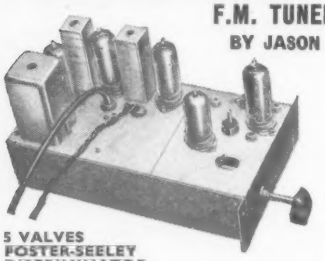
We carry a comprehensive stock of components by all leading manufacturers.

(Dept. WW) 207 EDGWARE ROAD · LONDON W.2.

YOU'LL DO BETTER WITH PREMIER

The latest
COLLARO
4-speed single player unit complete with pick-up and turnover cartridge £4/12/6
plus 2/6 pkg. and carr.

THE MERCURY SWITCHED F.M. TUNER BY JASON



5 VALVES
FOSTER-SEELEY DISCRIMINATOR

Complete set of parts can be purchased for £9.19.6 plus 2/6 p.p.
All the components can be purchased separately. The main components are as follows:—

Chassis	6/6
2 side panels, pair	3/-
Prefabricated front-end completely wired and tested with IEF80 and IECF80 (incl. P.T.)	£6/5/-
Discriminator	11/6
2 I.F. Transformers at 5/9 each	11/6
Complete instruction book	2/-

POCKET VOLT TEST METERS

Two ranges, D.C. 0-250 v., 0-25 v., complete with leads in canvas case. In leather case 1/6 extra. **12/6**
Plus 2/6 post and packing.
15 amp. M/C 2½in. Round Charging Meter, price 8/6, plus 1/- p. & p.
1 m/A M/C 2½in. Round. Price 21/6, plus 1/- p. & p.

2-VOLT 16AH BAKELITE CASED
ACCUMULATOR

By Oldham, Dagenite, Exide. New and unused, unspillable. 7⅛ × 4 × 2.
Price **6/6** plus 1/6 post and packing.

B.S.R. TU8 3-speed Record Player with Pick-up £3/19/6

Introducing—
LORENZ MODEL PL 562
4-speed gram. motor.
Price **£3 . 13 . 6**

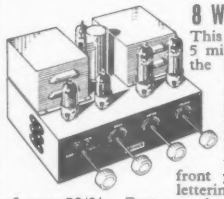
LATEST B.S.R. MONARCH 4-SPEED AUTOCHANGER

Designed to play 12in., 10in. and 7in. Records intermixed in any order at 16, 33⅓, 45 or 78 r.p.m. Capacity 10 Records. New reversible Dual Stylus Crystal Pick-up. For use on 100/250 v. 50 cycle A.C. mains. **£8.15.0**
Plus packing and postage 5/-.

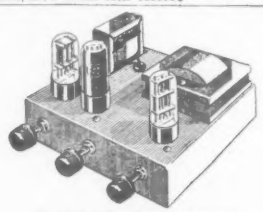
COLLARO R.C.456
4-SPEED AUTOCHANGER

Designed to play 12in., 10in. and 7in. Records intermixed in any order at 16, 33⅓, 45 or 78 r.p.m. Capacity 10 records. New reversible Dual Stylus Crystal Pick-up for use on 100/250 v. 50 cycle A.C. mains £8/19/6
Plus packing and postage 5/-.

8 WATT AMPLIFIER



This design includes 5 miniature valves of the latest types, an Ultralinear Output Transformer suitable for Speakers of 3 and 15 ohms, and a very attractive perspex front panel with gold lettering, complete set of parts £8/8/-. Postage and packing 5/- extra. Or £10/19/6 built and tested.



4 WATT AMPLIFIER

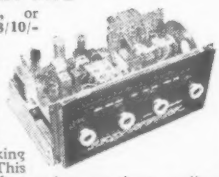
MAY BE BUILT FOR **£4 . 10 . 0** Plus 2/6 Pkg. & Postage

Instruction Book 1/- post free.
A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for £5/5/- plus pkg. and post 3/6, or fitted in case at £6 plus pkg. and post 3/6. Engraved panel 3/6. Post free.

CONTINENTAL STYLE CABINET

Dark Piano finished with gold and black styling, overall size 39in. long, 32¾in. high, 16in. deep. Two sliding doors, concealing on the left a black panel 18½in. × 20½in. finished medium mahogany, and on the right a detachable board 12½in. × 18½in. and a shelf which may be used for record storage.
Cash Price 18 gns., plus 25/- pkg. and carr. Credit Terms: Deposit £2/18/- and 8 monthly payments of £2/6/-.

AM/FM RADIOGRAM CHASSIS
OF THE LATEST TYPE

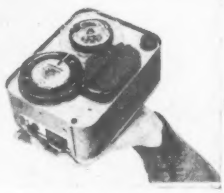


Cash £22/10/-, or Credit Terms £3/10/- Deposit and 8 monthly payments of £2/14/8. H.P. Terms £11/5/- Deposit and 12 monthly payments of £1/0/11. Packing and Carr. 7/6. This chassis has 8 valves and covers short, medium and long FM and Gram. Printed circuit on FM ensures a high degree of stability. Overall size 14in. long, 6½in. high, 9in. deep. Dial size 12 × 5½in.

Build the
ONEVALVE BATTERY RECEIVER
AS SHOWN ON B.B.C. T.V.

This Receiver contains a DAF96 valve and a pair of 4,000 ohm headphones and is powered by a combined 67½ and 1½ volt battery.
Price complete with headphones and including battery **45/-**
Send for free diagram.

TERMS OF BUSINESS
Cash with order or C.O.D over £1. Please add 1/- for Post Orders under 10/-. 1/6 under 40/-. Unless otherwise stated.



Introducing the
PHONOTRIX
BATTERY TRANSISTOR MINIATURE
TAPE RECORDER

Supplied complete with Microphone and small Loudspeaker, operates on 4 U2 Torch batteries, weighs only 4 lb. and plays for 30 minutes. Size 6½ × 4¾ × 3½in. complete plus 5/- pkg. and post.
Retail Price **26 gns.**
OR on Credit Terms: Deposit £3/8/- and 8 monthly repayments of £3/10/-.

2-BAND TRF RECEIVER MAY BE BUILT FOR £5.15.0

plus pkg. & post 3/-

3-BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7 . 19 . 6** Plus 3/- Pkg. & Postage

These two receivers use the latest type circuitry and are fitted into attractive cabinets 12in. × 6½in. × 5½in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each, post free.

THE JASON "ARGONAUT"
MW/FM DESIGN

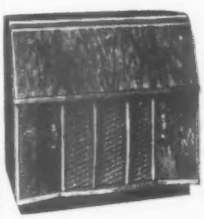
★ **All Premier components are designer approved**

ALL components to build the complete Receiver, including output stage, may be purchased for £15/5/-, or all components less output stage but including Power Supply, for £13/19/6, plus packing and postage 3/6 on each.

The new Spencer-West Band Three Converter is now available at £6/5/- plus pkg. and post 3/-.

Spencer-West Pattern Unit 25/- plus 1/- pkg. and post. For elimination of B.B.C. interference or I.T.A.

PREMIER BUREAU DE LUXE



A superb cabinet in finely figured walnut veneer. Interior light sycamore with rexine matching lining Overall dimensions: 33in. high, 34in. long, 17½in. deep. Uncut control panel on right-hand side approximately 16in. × 10½in., uncut baseboard on left-hand side 15½in. long, 13½in. deep. Two full size felt-lined storage cupboards in the lower part of the cabinet.
Cash price ..... 16½ gns.
Credit Terms: Deposit £2/6/6 and 8 monthly payments of £2/3/2. Packing and Carriage 25/- extra.

PREMIER RADIO CO. (Dept. W.W.) 207 EDGWARE RD., LONDON, W.2. Tel: AMBassador 4033

Plastic Mouldings by . . .

RANTON & COMPANY LIMITED

We are manufacturers of "Rock" Electrical Accessories, and have supplied a large range of plastic mouldings for various industries during the past 30 years.

The services of our Design Department, Tool Room, Injection and Moulding Presses are readily available, and we would welcome the opportunity of quoting members of the Radio and Allied Industries for their requirements.

IF YOU HAVE A MOULDING PROBLEM WE SHALL BE GLAD TO DISCUSS IT WITH YOU.

ROCK WORKS, COMMERCE ROAD, BRENTFORD, MIDDX.

Telephone: EALING 5808

JUST RELEASED!

POCKET-SIZE UNIVERSAL METER Model 122A

A small 21-range instrument ideal for the enthusiastic amateur. Sensitivity is 5,000 o.p.v. A.C. and D.C. Accuracy: 3% D.C. 4% A.C.
A high-sensitivity, moving-coil, centre-pole-type meter with 2½in. scale is fitted.

RANGES

Volts D.C. 0-3-15-30-150-300-1,500.
Volts A.C. 0-15-30-150-300-1,500.
Milliamperes D.C. 0-15-30-150-300-1,500.
Amperes D.C. 0-15.
Resistance 10 ohms—1 megohm.
Automatic overload protection fitted to meter movement.
Size: 4¾in. × 3¼in. × 1¾in.
Weight: 14 oz.

PRICE £9.5.0 PROMPT DELIVERY

All Taylor Instruments available on Hire Purchase and 7 days' approval. **Write for full details and Catalogue.**

TAYLOR ELECTRICAL INSTRUMENTS LTD.
MONTROSE AVENUE, SLOUGH, BUCKS.
Telephone: Slough 21381 Cables: Taylins, Slough

world-wide approval

Pye Telecommunications Limited are now marketing the widest and most modern range of V.H.F. fixed and mobile radio-telephone equipment available in the world. This range of equipment has been designed to expand the application of Pye Radio-Telephones already in constant use all over the world.

Pye Ranger V.H.F. equipment has now received approval from the British G.P.O. for Land and Marine applications employing A.M. or F.M. systems, type approval from the Canadian D.O.T. and type acceptance of the F.C.C. of the United States of America

Pye V.H.F. equipment is designed to meet the approval of authorities throughout the world. No other Company holds so many approvals for this range of equipment, which now covers every conceivable requirement.

We can offer

FREQUENCY RANGE
All frequencies from 25 to 174 Mc/s.

POWER RANGE
All powers up to 1 Kilowatt.

CHANNEL SPACING
All channel spacings including 20 and 25 kc/s in full production.

MODULATION
A.M. or F.M.

No matter what your V.H.F. requirements are, Pye Telecommunications Ltd., can fulfil them. Your enquiries are invited.

PYE

Leading the world in V.H.F. RADIO-COMMUNICATIONS

PYE TELECOMMUNICATIONS

distributors in 91 countries ensure trouble free service

PYE TELECOMMUNICATIONS LTD NEWMARKET RD CAMBRIDGE ENGLAND

Phone: Teversham 3131 Cables: Pyetelecom Cambridge

Wireless World

ELECTRONICS, RADIO, TELEVISION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: F. L. DEVEREUX, B.Sc.

APRIL 1958

In This Issue

153 Editorial Comment
154 Transistor Television Circuits — *By J. N. Barry and G. W. Secker*
160 Television Society Exhibition
162 Band-V Signal Strength — *By A. Hale*
164 World of Wireless
166 Personalities
168 News from the Industry
169 Atomic Electrons in Action — *By "Cathode Ray"*
173 Double Tetrode Oscillator — *By J. H. Andreae and P. L. Joyce*
177 Short-Wave Conditions
178 Magnetism in Materials—4 — *By D. H. Martin*
181 Pulse Counter F.M. Receiver — *By M. G. Scroggie*
184 Stabilized E.H.T. Unit — *By D. J. Collins and J. E. Smith*
187 Letters to the Editor
189 Technical Notebook
191 Transmission-Line Calculator — *By J. H. Andreae*
193 Exponential Horn Dimensions — *By J. R. G. Twisleton*
194 Re-charging Primary Cells — *By R. W. Hallows*
195 Valves Galore — *By Jack Darr*
198 Manufacturers' Products
199 April Meetings
200 Random Radiations — *By "Diallist"*
202 Unbiased — *By "Free Grid"*

VOLUME 64 No. 4

PRICE: TWO SHILLINGS

FORTY-EIGHTH YEAR OF PUBLICATION

Offices: Dorset House, Stamford Street, London, S.E.1

Please address to Editor, Advertisement Manager or Publisher, as appropriate.

Telephone: WATerloo 3333 (60 lines)

Telegraphic Address: "Ethaworld, Sedist, London."

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. *Telephone:* Waterloo 3333 (60 lines). *Telegrams:* "Iliffepres, Sedist London." *Annual Subscriptions: Home and Overseas*, £1 15s. 0d. *Canada and U.S.A.* $5.00. Second-class mail privileges authorised at New York, N.Y. BRANCH OFFICES: *BIRMINGHAM:* King Edward House, New Street, 2. *Telephone:* Midland 7191. *COVENTRY:* 8-10, Corporation Street. *Telephone:* Coventry 5210. *GLASGOW:* 26b Renfield Street, C.2. *Telephone:* Central 1265. *MANCHESTER:* 260, Deansgate, 3. *Telephone:* Blackfriars 4412. NEW YORK OFFICE: *U.S.A.:* 111, Broadway, 6. *Telephone:* Digby 9-1197.

A service for all who need complete data on Mullard valves, tubes and semiconductor devices

The Mullard Technical Handbook is a loose-leaf publication, issued on a subscription basis and containing data sheets on all Mullard valves, tubes and semiconductor devices in current production.

From one to twenty pages are devoted to each type, data including: standard ratings, recommended operating conditions and performance figures for various applications, limiting values, characteristic and performance curves.

Subscribers receive supplementary or revised sheets automatically as they are issued and thereby have early intimation of new introductions.

At present the Handbook comprises four volumes with the following contents:—

VOLUMES I and IA
Data on current Receiving and Amplifying Valves. Cathode Ray Tubes. Crystal Diodes and Transistors. Photocells. Cold Cathode Tubes. Small Thyratrons. Miscellaneous and Special Tubes.

VOLUME 2
Data on earlier type Receiving and Amplifying Valves and Cathode Ray Tubes still in limited production for the maintenance of existing equipment.

VOLUME 3
Data on Power Valves for Transmitting and Industrial Equipment.
Power Rectifiers. Large Thyratrons. Microwave Devices.

For full details of this service, including subscription rates and application form, write to the address below.

Mullard

Mullard Limited, T.S.D., Data and Publications Section,
Mullard House, Torrington Place, London, W.C.1.

Mullard

APRIL 1958

Vol. 64 No. 4

Wireless World

Stereophony from Discs

FOR some time work has been going on behind the scenes in most of the major gramophone recording companies of the world on the development of discs in which sounds from two separate sources are recorded in the same groove. These recordings can be extracted by a special pickup, with two degrees of freedom, and reproduced through separate amplifiers and loudspeakers to synthesize a sound field which, to the listener, has directional properties similar to those of the original.

The foundations of stereophonic recording on disc were firmly laid by A. D. Blumlein of E.M.I. in a British patent (394,325) granted in 1933. He showed that modulations of the groove at right angles to each other could be vertical and horizontal or both at 45° to the surface of the disc, and that one system could be converted to the other by taking the sum and difference of the electrical outputs from the two channels. Shellac records at 78 r.p.m. made by the Columbia Graphophone Company on this principle in 1933, were demonstrated recently by H. A. M. Clark at the Institution of Electrical Engineers as a prelude to examples of the latest experimental recordings by E.M.I. We have also been privileged to hear the Decca records which made a profound impression when they were demonstrated recently in America. Both these demonstrations left little doubt that the problems of cutting a groove with dual modulation and extracting the signals without noticeable distortion or crosstalk have been successfully solved by the use of modern techniques of recording with feedback cutters, and reproduction with lightweight pickup movements. The results from discs are practically indistinguishable from the master dual-track magnetic tapes from which they are transcribed.

The record manufacturers have been alive to the necessity for standardization before stereo discs are marketed on a large scale. We understand that agreement has been reached, independently by groups of companies in Europe and in America, on the same basic standards which, subject to confirmation, will be as follows: (1) Modulations to be mutually at right angles and inclined at 45°/45° to the surface of the record; (2) Playback to be with a stylus tip of 0.0005in radius; (3) Relative channel polarity to give predominantly lateral movement of the stylus when the inputs are approximately in phase; (4) Modulation of the outer groove wall to correspond with the right-hand sound channel, i.e. if the axis of the right-hand modulation is extended it cuts the axis of rotation above the record; (5) Frequency response to I.E.C. fine-groove playback standard (B.S. 1928: 1955).

There are fundamental differences in the processes of tracing lateral and vertical modulations of the groove, and the 45°/45° system has been chosen because it gives better symmetry in this respect between the two channels. The smaller stylus radius is necessary because with dual modulation the groove will at times be narrow and shallow, but it is also of advantage in giving a reduction of tracing distortion. Distortion is also reduced by the relative channel recording polarity which has been chosen.

The qualities of stereophonic sound reproduction as exemplified by H.M.V. "Stereosonic" magnetic tape records have made many converts, even among those with full knowledge of the very realistic results which have been achieved with multi-microphone and other studio techniques on single-channel l.p. records. Quite apart from the obvious spatial effects, there is, in the best stereophonic orchestral recordings, a clarity and definition which is immediately appreciated by musicians. We say "the best" advisedly for pseudo-stereophony can also introduce ludicrous incongruities such as levitations and expansions and contractions in the apparent size of musical instruments according to the registers in which they are playing! Much will depend on the skill of the studio managers and recording engineers, and what between them they put on the record. The qualities of some ordinary l.p. records seem to shine through all kinds of distortion in indifferent reproducers, and it is to be hoped that similar foolproof qualities will emerge from the stereo discs which are offered to the general public. The crude effects of marching bands, railway sounds, and even antiphonal choral singing can be safely left to look after themselves, but it remains to be seen whether the more subtle qualities will survive the vagaries of general usage. The purely spatial effects are likely soon to lose their novelty, and stereophony will displace the single-channel high-quality reproducing system only if it shows a gain in realism on all kinds of programme material which is commensurate with the extra cost of the equipment.

Transistor Television Circuits

By J. N. BARRY*, M.Sc.
and G. W. SECKER*

I—Synchronizing Separators and Timebase Oscillators

CONSIDERABLE progress has been made recently in the design of junction transistors in two directions. These are, first, that devices have been produced which are capable of operating at much higher frequencies than hitherto, and secondly, that considerable steps have been made to increase the power handling capacity of transistors. Even now no transistors are available which are capable of giving performances equivalent to valves in the r.f. and i.f. circuits of a television receiver, but the improved high frequency performance of recent devices such as the surface barrier and diffusion type transistors has enabled circuits to be designed capable of giving acceptable video amplifier characteristics.

In conjunction with increased power ratings, recent improvements in manufacturing techniques have produced transistors whose current gains remain reasonably constant up to large values of emitter current, e.g. up to several amperes in some cases. In addition thermal resistance figures† as low as a few degrees centigrade per watt, when devices are used with a specified heat sink, are now quoted. These figures, in conjunction with maximum junction temperatures for germanium transistors of up to 75°C, permit dissipations of ten watts or more at normal operating temperatures. The advent of such transistors means that circuits can now be designed to perform such functions as timebase output amplification and e.h.t. generation, in addition to high-power audio output amplification.

In the case of low-power medium-frequency devices there has been a continual trend in the direction of higher operating voltages. Thus the maximum voltage rating, which a few years ago stood around 10 volts, is now of the order of 60 volts for several currently available types. Such an improvement aids the design of circuits performing the functions of sync separators and timebase oscillators.

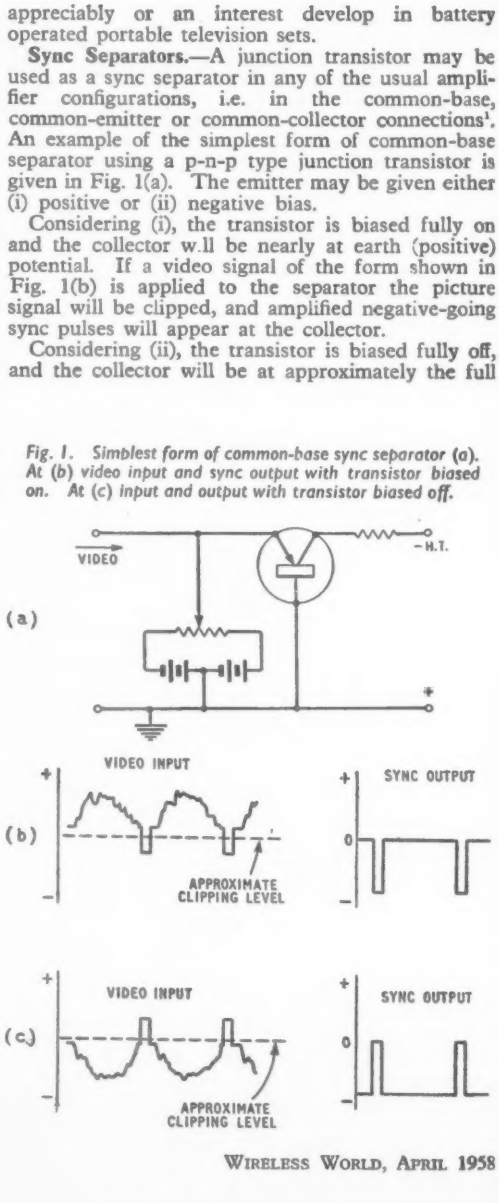
In the circuits which follow it will be seen that advantage has been taken in one way or another of all the recent improvements outlined above. The circuits are fairly economical in the number of ancillary components required, and could prove attractive should either the price of transistors drop appreciably or an interest develop in battery operated portable television sets.

Sync Separators.—A junction transistor may be used as a sync separator in any of the usual amplifier configurations, i.e. in the common-base, common-emitter or common-collector connections[1]. An example of the simplest form of common-base separator using a p-n-p type junction transistor is given in Fig. 1(a). The emitter may be given either (i) positive or (ii) negative bias.

Considering (i), the transistor is biased fully on and the collector will be nearly at earth (positive) potential. If a video signal of the form shown in Fig. 1(b) is applied to the separator the picture signal will be clipped, and amplified negative-going sync pulses will appear at the collector.

Considering (ii), the transistor is biased fully off, and the collector will be at approximately the full

Fig. 1. Simplest form of common-base sync separator (a). At (b) video input and sync output with transistor biased on. At (c) input and output with transistor biased off.



* Research Laboratories, General Electric Company.

† Thermal resistance, θ, is defined as the rise in collector junction temperature per unit power dissipation under specified conditions.

[1] "Transistorised Sync Separator Circuits for Television Receivers," by H. C. Goodrick, in "Transistors I" book (RCA Laboratories, 1956), p. 561.

h.t. negative potential less the voltage drop in the collector load due to the collector leakage current I_{co}. If a video signal of the form shown in Fig. 1(c) is applied to the input of the separator, amplified positive-going sync pulses appear at the collector as shown. This common-base type of separator may be adjusted to give clean rectangular sync pulses but possesses several disadvantages which include:

(1) The use of a fixed bias on such a separator means in practice that the greatest sync pulse output is obtained for a particular level of video input signal.

(2) In order to achieve fast turn-on and turn-off times, the separator has to be fed with a video signal from a low-impedance source.

(3) Compared with the common-emitter type of separator described later in this section, the common-base circuit is relatively insensitive.

Referring to Fig. 1(c) it may be seen that a common-base separator which is biased off requires a video input as shown. This video waveform could be obtained from a small resistor in the anode circuit of the video amplifier stage of a typical receiver which uses cathode modulation of the c.r.t. Experiments have shown that such an arrangement is hardly practicable, however, since the video input to the separator tends to be small and usually comparable in amplitude to the ripple on the h.t. line of the receiver.

Many of the disadvantages already mentioned may be overcome by the use of a common-emitter type of separator. If this arrangement is used in a biased-off condition it is possible for the separator to be self-biased. In addition, a separator which is biased off generally gives a sharper initial rise to the output pulse than one which is biased on. This is probably due to the fact that a device which is biased off has a much lower value of effective output capacitance. If the separator is driven into collector current by the sync portion of the video input signal, any degradation of the output pulse due to carrier storage effects in the transistor will tend to occur on the trailing edge.

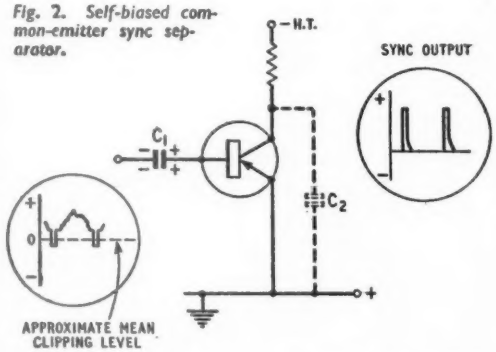


Fig. 2. Self-biased common-emitter sync separator.

An example of this type of circuit is shown in Fig. 2. The base-emitter junction conducts on the tips of the negative-going sync pulses and the capacitor C_1 becomes charged as shown. Amplified positive-going sync pulses are then obtained at the collector. This circuit operates in a rather similar manner to a self-biased Class C amplifier. The discharge time-constant of the input circuit may be considered as C_1R, where R is the back resistance of the base-emitter junction. In addition, the value of C_1 should be such that it does not introduce a reactance at the frame frequency which is large in comparison with the input impedance of the separator. Experiments have shown that in order to avoid a loss of frame pulse output C_1 should be not less than $2\mu F$.

Although this circuit requires to be driven from a low-impedance source it is considerably more sensitive than the common-base type already mentioned. In addition, in a typical television receiver using cathode modulation of the c.r.t. a suitable low-impedance source of video signal of the required polarity is available from the cathode bias resistor of the video amplifier.

It may be noted that the output capacitance of the transistor (C_2 in Fig. 2) imposes a limit to the value of collector load resistance which may be used. Experiments have shown that a collector load of 47kΩ is suitable for use with a transistor such as type EW80‡ for producing line sync pulses when operated from 60V h.t.

It may be mentioned that the output capacitance, C_2, is a function of the collector junction capacitance C_c, which is itself a function of the collector voltage, V_c. Thus for alloyed junction type devices:

$$C_c \propto \frac{1}{\sqrt{V + U}}$$

where U = the barrier potential across the collector-base junction (approximately 0.25 volt), and

$$C_2 \simeq \alpha_{cb} \cdot C_c$$

where α_{cb} = the common emitter current gain factor.

When the transistor is driven into current by the sync portion of the video input signal the collector voltage rapidly decreases, the transistor bottoms and C_2 assumes its greatest value. The recovery time will be partly governed by the time taken for C_2 to recharge via the collector load resistance. Since the value of C_2 decreases with increasing voltage the recovery time will be less than if C_2 were fixed at its maximum value.

Typical performance figures of the common-emitter circuit using a type EW80 transistor with a collector load of 47kΩ and 60V h.t. are:

Input signal	approximately 0.25V peak sync amplitude
Output line sync amplitude	approximately 50V peak
Rise time	approximately 2 μsec
Decay time	approximately 4 μsec
Mean collector potential ..	approximately 28V
Mean collector current ..	approximately 0.5mA
Mean collector dissipation	approximately 14mW

It may be noted that since the base of the separator is biased positively and conducts only on the tips of the sync pulses, the leakage current through the collector circuit will be less than the collector to emitter leakage current I_{ceo}. Also, if the base reaches a potential of approximately 0.25V positive with respect to the emitter the leakage current will approach its limiting value of I_{co}. Under these conditions the peak pulse output will approach the h.t. voltage.

The transistors used as sync separators were selected to have a high value of collector breakdown voltage. Specimens which gave the best results had an I_{co} of less than $8\mu A$ at a collector potential of approximately −70V.

‡ This type is essentially a high voltage version of type GET4.

Fig. 3 shows a practical form of a common-emitter sync separator circuit which was incorporated in a standard 17-inch receiver. The circuit has been modified slightly to work from the existing 200-V h.t. line in the receiver; R_1 and C_1 are included to limit the current through the emitter-base junction of the separator when the receiver is switched on. Line sync pulses are developed across R_3 and frame sync pulses are obtained across R_2 and C_2. A typical clipping circuit employing a GEX54 germanium diode is used to remove integrated line pulses from the frame pulse output.

The Z77 thermionic valve sync separator normally incorporated in the receiver produces negative-going sync pulses, which are applied to the screen of the line oscillator and the grid of the frame oscillator. It was found that the line oscillator would lock equally well from positive-going sync pulses applied to the screen via a small coupling capacitor, provided the delay time introduced was kept sufficiently small. In the case of the frame oscillator it was found that satisfactory operation was obtained with positive-going sync pulses applied to the oscillator triode anode.

Outputs of up to 90V peak line sync pulse and approximately 40V peak frame sync pulse (after clipping) could be obtained when using suitable transistors, for an input to the separator of approximately 0.25V peak sync amplitude.

Satisfactory synchronization was achieved with either the Z77 or transistor separator in circuit down to the same minimum level of input signal. The minimum input to the transistor separator at which satisfactory line and frame hold could be maintained was of the order of 0.05V peak sync amplitude (measured at the cathode of the video amplifier).

The frame interlace obtainable with the transistor separator in circuit was considered to be good (approaching 50-50).

In addition, the line tearing observed in the presence of locally generated impulse interference was slightly less when the transistor separator was used.

Blocking Oscillators.—In dealing with the timebase section of the 17-inch receiver, a blocking oscillator was used as the waveform generator, as this type could most conveniently be used with the existing thermionic valve output stages. The waveform generator developed for the frame timebase was subsequently used in conjunction with a transistorized output stage (to be described in Part 2 in a future issue).

Fig. 4 shows the basic blocking oscillator circuit[1], and Fig. 5 gives the voltage waveforms obtained at the collector (V_c), the base (V_b), and the emitter, (V_e). These indicate the voltages obtained when using a supply of 24V.

The transformer T_1 (Fig. 4) is connected such that the collector and emitter voltages are in phase. Assume the circuit to be initially uncharged and the h.t. then switched on; C_1 and R_1 together with L_1 and C_2 in parallel form a series charging circuit across the h.t. supply. (R_1 is appreciably less than the back resistance of the collector-base junction.) The collector voltage increases negatively, approximately in a linear manner, according to the curve V_c (Fig. 5) and the emitter voltage at first increases similarly although at a slower rate (curve V_e, Fig. 5), due to the step-down ratio of the transformer T_1. The voltage at the base (curve V_b, Fig. 5) increases initially more slowly than the emitter voltage, thus maintaining the emitter-base junction in a high resistance condition.

When the base voltage becomes very slightly negative with respect to the emitter the base-emitter junction conducts and the capacitor C_1 discharges through the transistor and L_2. The base current is amplified by the current gain factor α_{cb}, and causes a large pulse of current to pass via the collector and emitter. This produces a rapid voltage change at the collector and, combined with the action of L_2, the collector voltage is carried to a positive value. This causes the collector-base junction to become a low resistance and the base capacitor acquires a positive potential, thus blocking off the emitter circuit which consequently rings (curve V_e, Fig. 5). The negative portion of the ring reflected through the transformer is sufficient to carry the collector potential negative with respect to the base and to bias the collector-base junction in its high resistance condition. The cycle then repeats.

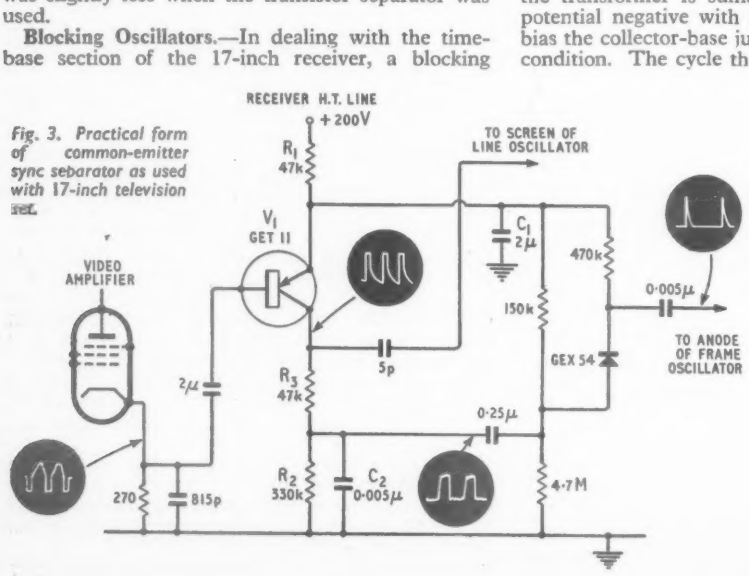


Fig. 3. Practical form of common-emitter sync separator as used with 17-inch television set.

A negative-going sawtooth voltage approximately equal to twice the h.t. voltage is produced at the collector. If an n-p-n transistor is employed a positive-going sawtooth voltage output may be obtained. (Note: both p-n-p and n-p-n types may be operated from either polarity d.c. supply by suitable arrangement of the circuit, but the polarity of the sawtooth waveform is dependent on the type of transistor used.)

It was found by experiment that the best results were obtained

[1] British Patent Application No. 17058/57.

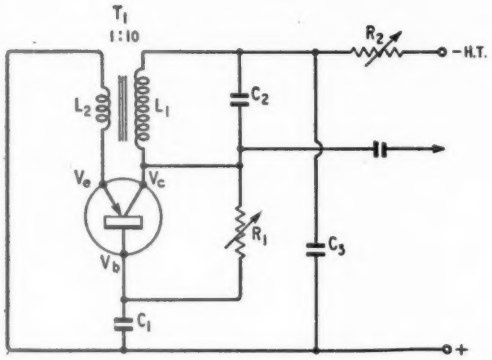


Fig. 4. Basic transistor blocking oscillator circuit.

using a transformer of about 10 to 1 step-down ratio between collector and emitter. A ratio of about 4 to 1 gave a slightly larger output voltage at the collector but of an inferior wave shape, and a ratio of about 20 to 1 tended to produce a sine wave output rather than a sawtooth.

Increasing the values of L_1 and C_2 tended to give a more linear rise waveform, but increasing C_2 or the resistance of L_1 or L_2 tended to lengthen the retrace time of the sawtooth output. Adjustment of R_2 gave a variation of output voltage of approximately 2 to 1 without significantly affecting the wave shape or period.

Synchronization was best effected by applying the appropriate sync pulse to the base terminal. When an n-p-n transistor is used a positive-going sync pulse is required at the base, alternatively a negative-going sync pulse is needed for the p-n-p type. It was found that a sync pulse amplitude of the order of 0.5V peak would give a satisfactory lock.

Frequency control is effected by variation of R_1, which controls the voltage across the base capacitor C_1. In addition, the turns ratio of T_1 also influences the frequency, since the instant at which the flyback commences is determined by the bias conditions existing at the base-emitter junction.

It may be noted that the transistor passes current mainly during the flyback period. Since the base-emitter junction is biased off during the rise period the collector current will be of the order of I_{co} until the flyback occurs.

No tendency to thermal instability was encountered at temperatures of the order of 25°C. Further investigation of the performance of this circuit at higher temperatures was not carried out. Provided, however, that the minimum value of R_2 is such that the maximum dissipation of the transistor cannot be exceeded no trouble should be encountered.

The circuit of the line oscillator is given in Fig. 6. Approximately 45V peak-to-peak of positive-going sawtooth output voltage was obtained by using an n-p-n transistor, type 2N98**, supplied from 24V h.t. The retrace time of the output waveform was approximately 10μsec. It was found that the e.h.t. generated by the line output stage was

** This type of transistor was used as there were no suitable n-p-n types available on the British market.

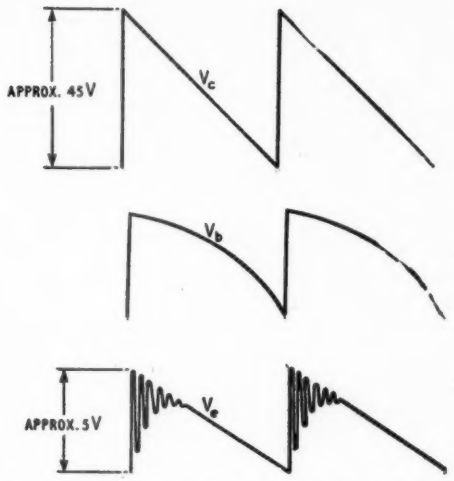


Fig. 5. Waveforms obtained with the Fig. 4 blocking oscillator circuit (using a p-n-p transistor).

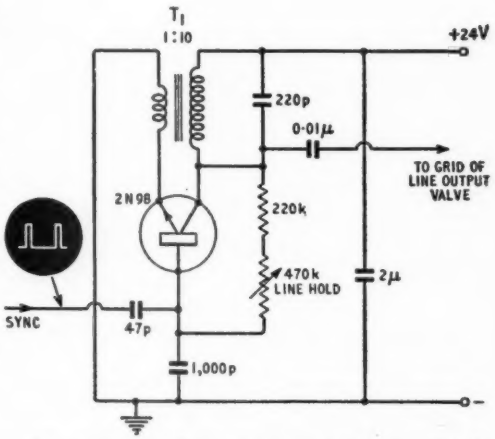


Fig. 6. Line oscillator circuit used with the 17-inch receiver. Details of T_1:—primary, 200 turns 34 s.w.g. Lewmex (not interleaved) 2 layers 3 mil paper, 72mH 4.5Ω; secondary, 2,000 turns 40 s.w.g. Lewmex (not interleaved); bobbin, midget Angelina; core, midget 0.015in Radiometal T and U stampings interleaved.

approximately 12kV when driven by the transistor oscillator compared with approximately 14kV when driven by the thermionic valve circuit of the receiver. (This comparison was made on Test Card C with the same settings of brightness and contrast.)

Sync pulses were applied to the base via a 47-pF capacitor from the p-n-p type separator described above. With a sync pulse amplitude of approximately 2V peak applied to the base, the line oscillator was found to pull in to lock between free-running frequencies of approximately ±10% on the nominal 10.125 kc/s.

The effect of increasing temperature on the free-

running frequency of the oscillator was not investigated. It was noted, however, that once the timebase was correctly synchronized, no adjustment of the "hold" control was required for an operating period extending over several hours. This was also true in the case of the frame oscillator.

It may also be noted that a significant advantage of such transistor oscillators is that they require only a relatively small amplitude input pulse for satisfactory synchronization.

The line linearity with the transistor oscillator was slightly better than that obtained with the thermionic valve circuit.

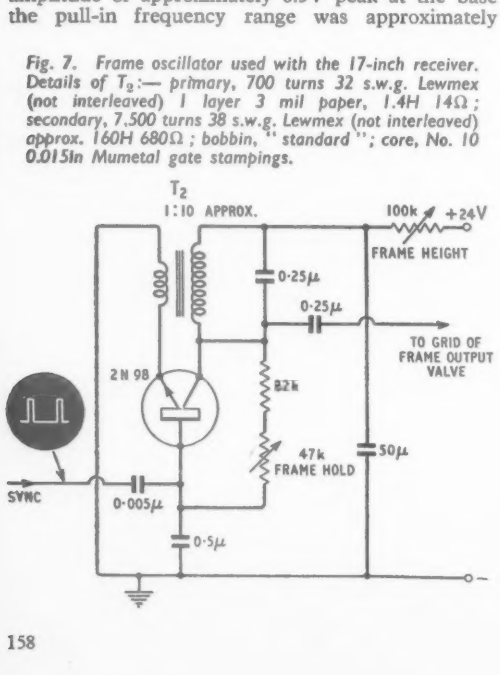
The current consumption was approximately 0.7mA at 24V h.t.

The original thermionic valve frame oscillator in the receiver produces a sawtooth which is peaked at the beginning and the end of the rise waveform. This is done to correct for any decrease in mutual conductance of the frame output valve with increasing negative bias and also to offset saturation effects in the frame output transformer. It was found to be impracticable to produce a similar waveform from the transistor blocking oscillator of sufficient amplitude fully to drive the existing frame output stage. A solution was found by obtaining a large amplitude of linear sawtooth voltage from the transistor blocking oscillator and by increasing the amount of corrective feedback on the frame output valve.

The circuit of the frame oscillator is given in Fig. 7, and the modifications to the frame output stage are shown in Fig. 8.

Approximately 45V peak-to-peak of positive-going sawtooth output voltage was obtained from the frame oscillator, which used an n-p-n transistor, type 2N98. The retrace time of the sawtooth waveform was approximately 0.6 msec. Sync pulses from the p-n-p type separator described above were applied to the base. With a sync pulse amplitude of approximately 0.5V peak at the base the pull-in frequency range was approximately

Fig. 7. Frame oscillator used with the 17-inch receiver. Details of T_2:— primary, 700 turns 32 s.w.g. Lewmex (not interleaved) 1 layer 3 mil paper, 1.4H 14Ω; secondary, 7,500 turns 38 s.w.g. Lewmex (not interleaved) approx. 160H 680Ω; bobbin, "standard"; core, No. 10 0.015in Mumetal gate stampings.



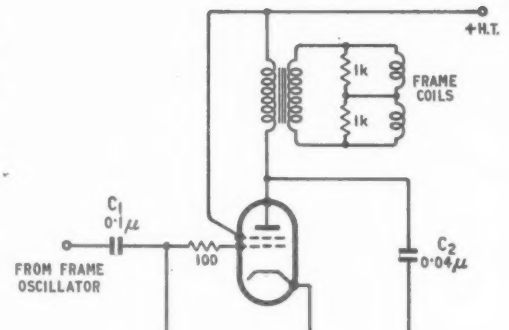


Fig. 8. Original frame output stage of the 17-inch receiver. Modifications for use with the transistor frame oscillator:—C_1 increased to 0.25μF; C_2 increased to 0.1μF; R_1 replaced by short circuit.

±10%. The current consumption at 24V h.t. was approximately 1mA.

Line and frame linearity measurements were made using Test Card C with the transistor line and frame oscillators incorporated in the receiver. The non-linearity was as follows: line, 4%; frame, 14%.

The frame non-linearity was such that the height of a rectangle was a maximum in the middle of the picture and decreased uniformly towards the top and bottom.

Additionally, it was found that the line and frame hold were maintained with an input signal level to the transistor sync separator of approximately 0.05V peak sync amplitude (as given earlier). The frame interlace obtained appeared to be satisfactory, i.e. approaching 50-50.

The linearity measurements were made on the c.r.t. using dividers and a ruler. Care was taken to avoid parallax errors. Frame non-linearity was calculated as follows:

If x cm = height of the tallest "background" rectangle on Test Card C, and y cm = height of the shortest equivalent rectangle on the Card, then non-linearity $= \frac{2(x-y)}{x+y} \times 100\%$. To calculate the line linearity the widths of rectangles were measured and used in the same formula. The extreme left-hand and right-hand rectangles of Test Card C were excluded since these are narrower than those in the middle of the test pattern.

A subjective comparison of the timebase linearity for both line and frame in the case of (a) the receiver in its original condition, and (b) the receiver with the transistor line and frame oscillators incorporated, indicated that the results in both cases were very similar.

(To be concluded.)

Exhibitors at the I. E. A. Show

THIS year's Instruments, Electronics and Automation Exhibition (Olympia, April 16th-25th) has the official backing of the radio and electronics industry, the Electronic Engineering Association (formerly R.C.E.E.A.) being one of the six sponsoring bodies of the show. An even greater number of the 240 U.K. exhibitors than last year are either in the industry or their products are used extensively in the manufacture or testing of radio and electronic equipment. The Scientific Instrument Manufacturers' Association and British Electrical and Allied Equipment Manufacturers' Association are among the five original sponsors of the show.

In addition to the U.K. radio and electronics exhibitors listed below, some 60 overseas manufacturers are represented, most of them by their U.K. agents.

As last year a conference is being run in association with the exhibition, but this year it will be confined to the mornings.

Among the conference papers is one by Dr. A. D. Booth (director of the Birkbeck College Computation Laboratory) on "Computers—Numerical Automation." Dr. G. E. R. Deacon, director of the National Institute of Oceanography, will deal with "Progress in the International Geophysical Year." Others will deal with instrumentation in various industries and in scientific research.

The exhibition opens daily (except Sunday) at 10.0 and closes at 6.0 except on the 18th and 23rd, when it will remain open until 9.0. Admission 2s 6d.

A.D.S. Relays
Advance Components
Airmec
Air Trainers Link
All-Power Transformers
Amplivox
Anglo-Netherland Technical Exchange
Associated Automation
Automation Progress
Avo

B.T.H.
Bailey Meters & Controls
Baldwin Instrument Co.
Belling & Lee
British Communications & Electronics
British Electric Resistance Co.
British Physical Laboratories
British Power Transformer Co.
British Tabulating Machine Co.
Brown, S. G.
Burndept

Cambridge Instrument Co.
Cass & Phillip
Cinema-Television
Colvern
Cooke, Troughton & Simms
Cossor Instruments
Counting Instruments
Crompton Parkinson
Crosfield, J. F.
Croydon Precision Instrument Co.

Dawe Instruments
Day, J., & Co.
Dynatron Radio

Ega Electric
Ekco Electronics
Electrical Remote Control Co.
Electroflo Meters
Electro Methods
Electronic Components
Electronic Engineering
Electronic Instruments
Elliott Brothers (London)
E.M.I. Electronics
English Electric
English Electric Valve Co.
Ericsson Telephones
Evans Electroselenium
Everett, Edgcumbe & Co.
Evershed & Vignoles

Fairey Aviation
Fielden Electronics
Fleming Radio (Developments)
Foxboro-Yoxall

G.E.C.
General Radiological
Gloster Aircraft Co.
Goodmans Industries

Hallam, Sleigh & Cheston
Hatfield Instruments
Headland Engineering Developments
Hilger & Watts
Honeywell-Brown

Imhof, Alfred
Instruments and Automation
Instrument Practice
Instrument Review
Integra, Leeds & Northrup

Jobling, James A., & Co.

Kelvin & Hughes (Industrial)
Kent, George
Kerry's (Ultrasonics)

Langley London
Laurence, Scott & Electromotors
Lintronic
Livingston Laboratories

Magnetic Devices
Marconi Instruments
Metropolitan-Vickers
Microcell Electronics
Microwave Instruments
Minerva Detector Co.
Ministry of Supply
Morgan Crucible Co.
M.S.S. Recording Co.
Muirhead
Mullard

N.S.F.
Nagard
Nalder Brothers & Thompson
Nash & Thompson
New Electronic Products
Nuclear Engineering

Painton & Co.
Panellit
Paul, K. S.
Peebles, Bruce, & Co.
Philips Electrical
Plessey Development
Plessey International
Process Control & Automation
Pullin, R. B., & Co.
Pye, W. G., & Co.

Racal Engineering
Radiovisor
Reilly Engineering
Robinson, F. C., & Partners

Sanders, W. H., (Electronics)
Sangamo Weston
Semiconductors
Servomex Controls
Shaw Moisture Meters
Short Brothers & Harland
Siemens Edison Swan
Simmonds Aerocessories
Smiths Industrial Instruments
Society of Instrument Technology
Solartron Electronic Group
South London Electrical Equipment
Southern Instruments
Sperry Gyroscope
Sunvic Controls

Taylor Controls
Technical Ceramics
Technical Sales
Technograph Electronic Products
Teledictor
Telegraph Construction & Maintenance
Telephone Manufacturing Co.
Turner Electrical Instruments
20th Century Electronics

Ultrasonoscope Co. (London)

Vactric (Control Equipment)
Venner Electronics

Wayne Kerr Laboratories
W.S. Electronics (Production)
Wireless World and *Electronic & Radio Engineer*

Instructional Films on Transistors

FIVE new 16-mm sound films have recently been produced by Mullard to illustrate the basic principles of semiconductors, transistors and their application in radio receiver circuits.

"The Transistor—Its Principles and Equivalent Circuit" lasts 15 minutes and is in colour. It is at a fairly high technical level and a detailed analysis of the complete and approximate equivalent circuits used in design is preceded by animated diagrams showing current carriers under different circuit conditions. This film serves as an introduction to "The Junction Transistor in Radio Receivers," which is in two parts: 1.—"Design of an I.F. Amplifier" (15 minutes) and 2.—"The Complete Receiver" (10 minutes). A third film, "The Manufacture of Junction Transistors" (10 minutes) gives a close view of the techniques employed at the Mullard factory at Southampton. All the foregoing are available from the Publicity Division of Mullard Ltd. Torrington Place, London. W.C.1.

Another 16-mm sound film, "The Principles of the Transistor" (20 minutes, black and white), and a colour film strip, "Semi-conductor Devices" (35 mm) have been produced for teaching by the Mullard Educational Service in collaboration with the Educational Foundation for Visual Aids to whom schools should make application; other organizations should apply to the Mullard Educational Service.

Television Society Exhibition 1958

COLOUR RECEIVERS AND TEST EQUIPMENT

AT the Television Society's exhibition this year the main accent was on colour. Four manufacturers (Bush, Ekco, G.E.C. and Murphy) were showing experimental receivers designed for the B.B.C. tests of the "Anglicized" N.T.S.C. system. These were, in the main, similar—all used the R.C.A. tri-gun shadow-mask tube which dictates, to a large extent, the design of the receiver.

One of the main differences between the sets was in the local sub-carrier oscillator section. This oscillator must be accurately synchronized with the sub-carrier burst which occurs during the back porch of the line synchronizing pulse, and the maximum phase "wander" which can be allowed between colour bursts is very small. The transmitted sub-carrier can change by as much as ±8 c/s from its nominal frequency, and the local oscillator in the receiver also drifts. These factors render mandatory the use of an a.f.c. system.

The Bush and Ekco receivers on show were using a crystal-controlled oscillator with a relatively simple a.f.c. system, while G.E.C. and Murphy were employing a much more comprehensive system (phase discriminator and quadri-correlator) to give the wide pull-in range necessary with a less stable oscillator. (A full description of the Murphy receiver appeared in the March and April 1956 issues of *Wireless World*.)

The sub-carrier frequency must be attenuated in the luminance channel to avoid the "crawling-dot" effect and the possible desaturation of colours. Particular care has been taken in the design of the filter in the Bush receiver so that the luminance information in the picture is not adversely affected. The trap is of the "bridged T" type, having a stop-band only 200 kc/s wide. This, coupled with the excellent response of the i.f. amplifier enabled the receiver to produce a picture of excellent definition.

The colour rendering varied greatly between receivers —even between two receivers of the same manufacture —and, like the little girl with the curl, when it was good it was very, very good, but when it was bad it was horrid!

Colour signals at the exhibition came from three sources: the B.B.C. Channel 1 colour test transmissions; colour slides from a scanner at the Kew laboratories of Bush Radio; and a G.P.O. colour bar generator.

The B.B.C. transmissions were received in the normal way and distributed by a standard "Belling-Lee" distribution system.

The colour slide scanner and encoding equipment at Kew was used to modulate an amateur television transmitter (call sign G3ILI/T) operating on 439 Mc/s. This was received on a stack of four six-element Yagi aerials, converted to Channel 2 and fed into the distribution network.

The G.P.O colour bar generator was noteworthy for its considerable economies in size and number of valves. These were accomplished by feeding the output from the colour sub-carrier oscillator along a delay line with an imperfect magnetic shield. Pickup coils mounted along the delay line at positions appropriate to the phase-shift required for any particular colour have their outputs gated and combined with synchronizing pulses into a composite colour bar pattern waveform. This, too, was used to modulate a carrier which was fed into the distribution system.

Mention must be made of colour display system developed and exhibited by R. W. Wells. Interference phenomena occurring when linearly polarized light is passed through a substance such as Cellophane can produce colours, the actual hue depending on the position of the molecular "grain" of the Cellophane or the plane of polarization of the light. This method of producing colour is used in front of the display c.r.t. as an infinitely variable subtractive colour filter. Instead

The Ekco colour receiver. The picture on the screen is a test slide from the amateur transmitter G3ILI/T.

The B.B.C. television peak white signal to r.m.s. noise ratio meter. The meter panel is shown in the operating position.

of relying on physical movement of the Cellophane or the polarizing medium to produce the colours (this has always been the downfall of a system of this type in the past) the plane of polarization of the light is shifted by a rotator employing the Faraday effect.

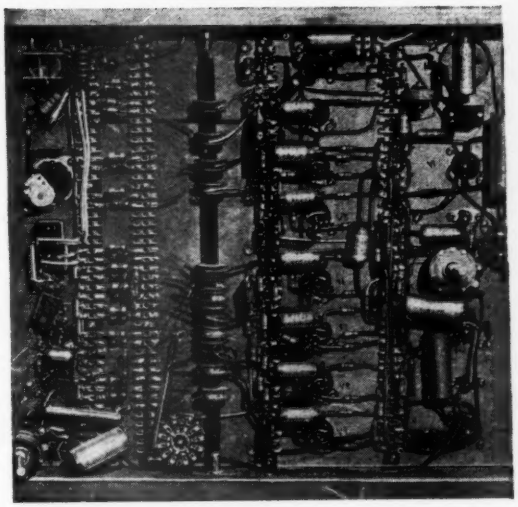
The system is clearly in an early stage of development —possibly on a par with John Baird's original 30-line monochrome demonstrations—but even the two-colour sequential frame demonstration given shows that the system is, in principle, workable.

Test equipment on show included new transistorized pattern generators by Thorn Electrical Industries and Siemens Edison Swan. Both generators employed binary digital techniques, instead of the more usual synchronized "count-down" circuits, to give better long term stability. Thorn were also showing a development model of a generator with a long lock-in time constant so that it could be locked to the mains supply without manual frequency correction.

Siemens Edison Swan had set up the equivalent circuit of a line output stage with a motor-driven capacitor tuning the leakage inductance. The reduction in peak voltage across the transformer and ringing when the leakage inductance was tuned to the third harmonic was seen clearly on an oscilloscope.

The B.B.C. exhibit included a TV signal-to-noise ratio meter. The measurement of the true signal-to-noise ratio of a television system is difficult, because among other factors the synchronizing pulses and camera lens aberrations can upset results. To overcome these difficulties the central portion of a peak white raster is gated out and the d.c. component cancelled, leaving pulses of noise. These are measured on an r.m.s. meter. The output from an internal oscillator (previously set to peak white amplitude) is then applied to the meter, and a calibrated attenuator adjusted to give a deflection equal to that given by the noise. The peak white signal to r.m.s. noise ratio can then be read directly from the attenuator.

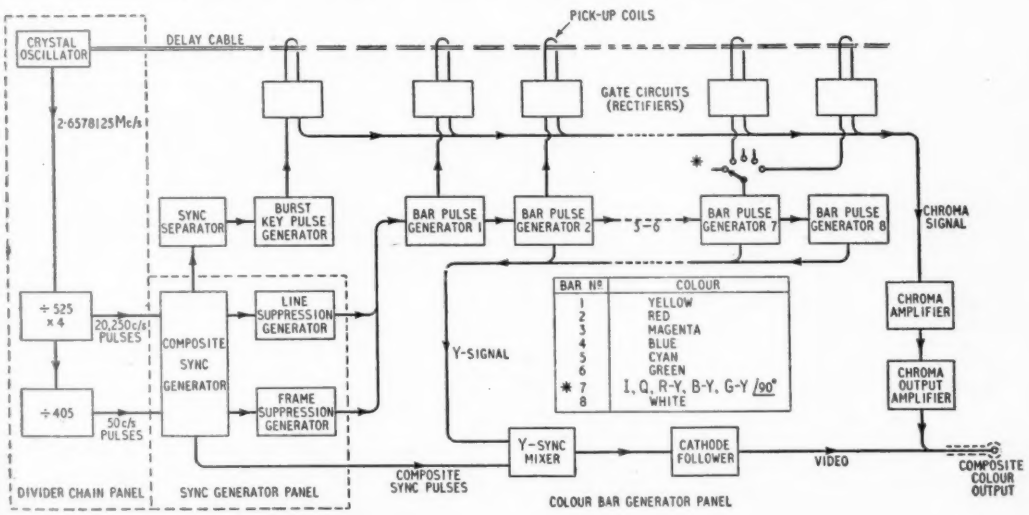
The exhibit organized by Norwood Technical College featured methods of adapting class demonstration techniques to present day crowded conditions where each classroom or laboratory is utilized to the maximum possible extent. Under these conditions the only time available for setting up demonstrations is the short interval between two consecutive teaching periods. The example of a video amplifier was shown. Individual components could be plugged into circuit with wander plugs to simulate the effects of various distortions and to show how compensation for these distortions is applied.



The gating and mixing circuits and delay line of the G.P.O. colour bar generator. (Pat. App. No. 6610/58.)

Three firms (Aerialite, "Belling-Lee" and Wolsey) were showing aerials for the present B.B.C. monochrome tests in Band V.

The "Belling-Lee" stand featured aerial development and measurements. Two of the most interesting items on show were a Rohde and Schwarz semi-automatic impedance bridge which indicates directly the impedance of an aerial on a Smith chart and a high speed automatic polar diagram plotter. This displays the polar diagram of a scaled down aerial on the screen of a long persistence c.r.t. The aerial is rotated, this rotation being coupled to the c.r.t. by a magslip. The spot is brightened at a distance from the centre of the tube depending on the signal amplitude, thus displaying the polar diagram of the aerial under test.



Block schematic diagram of the G.P.O. colour bar generator.

Band-V Signal Strength

Investigation of Reception Conditions Along Two Routes Radiating from London

By A. HALE*, A.M.I.E.E.

SINCE the start of the B.B.C. Band-V test transmissions an attempt has been made to determine the effective range of the signals, and to get some idea of the difficulties likely to be encountered in installing aerials. The points of interest so far investigated concern the effect of ground contours on the signal strength, and the local variation of the signal when a receiving aerial is moved small distances in a built-up area.

Ground Contours

The results of two series of measurements of signals over long radials from the transmitter are shown in Figs. 1 and 2. The test procedure was to mount a Band-V aerial at a height of 25ft on a vehicle, and carry out field-strength measurements at frequent points on, or as near as possible on, routes radiating from the transmitter. The readings, expressed as dB relative to 1μV of the voltage appearing at the terminals of the test array, are plotted, and are compared with the height of the ground above sea level. The aerial used on all these tests comprised a standard commercially available "box" array, consisting of four Yagi aerials each having 4 directors, a folded dipole and reflecting screen. The aerial gain was 13dB above a half-wave dipole.

The two routes covered by Figs. 1 and 2 are basically along roads A5 and A10, stretching as far as Towcester and Cambridge respectively. In all cases readings were taken on good sites, where there was no undue local shielding.

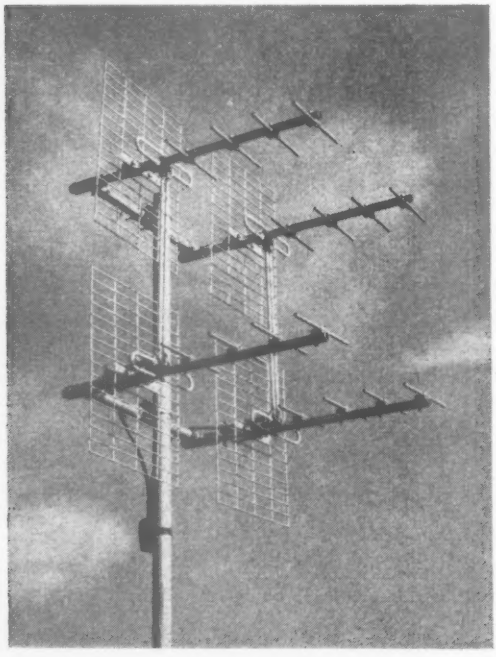
Points of interest are that the range of the transmitter is much greater than was at first expected, and quite good pictures were obtainable at more than 50 miles from the transmitter, providing the receiving site was situated near the top of a hill. It is significant to note that signal strength variations follow the ground contours very closely, and fall to low levels in valleys even close to the transmitter. The type of signal variation is very similar to that found on Band III, but is noticeably more severe.

Local Variations

The curves in Figs. 1 and 2 give an idea of the signal available at a good site, but it was considered likely that screening from buildings could account for very much worse results than these curves indicate. Tests were therefore made using the same aerial but this time connected via a measuring set and short time-constant rectifier to a pen recorder. The aerial mounted on the vehicle then moved down a straight road and signal variations recorded. The aerial was oriented for maximum signal at all times. As a highly directional array was used the signal variations can be assumed to be due exclusively to shielding and standing waves do not affect the result.

The curve shown in Fig. 3 is the result of a typical part of a test run taken in Bengeo (Hertford) by moving down a road approximately at right angles to the signal path. The road in question was in the middle of a housing estate, and was on a fairly flat hill top. The aerial was at about roof ridge height,

* Belling and Lee Ltd.



The aerial used for the measurements of signal strength on Band V and described in the text.

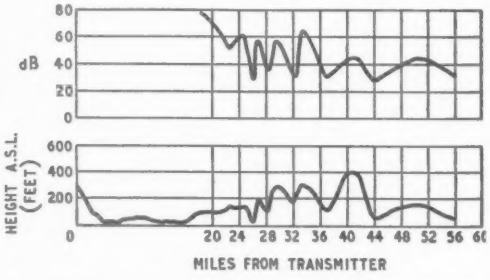


Fig. 1. Variations in signal strength on Band V and contour of country along road A5 towards Towcester.

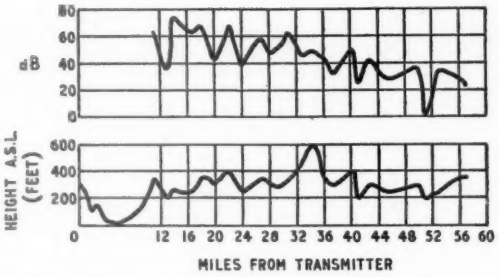


Fig. 2. Variations in signal strength on Band V and contour of country along road A10 towards Cambridge.

that is at about the same height as normally installed Band-I and -III aerials. For comparison similar curves of the same section of road are shown in Figs. 4 and 5 for Bands I and III respectively. In these cases a "H" and a six-element aerial were used.

It can be seen that whilst signal variations are very violent, they are much as would be expected from the lower frequency tests. In general, the higher the frequency the more intense the variation of signal.

As a conclusion from these limited tests, it can be deduced that Band-V signals can be received at ranges well beyond the optical horizon, provided the receiving site is well placed. Conversely, close to the transmitter, a bad site in a valley may be unable to receive signals. In all cases, it is very necessary to move the aerial around the site and select a position where the signal is strong. This advice has been given many times for Band III, but on Band V the procedure becomes essential, and the aerial cannot be fixed in the most convenient place regardless of the signal strength.

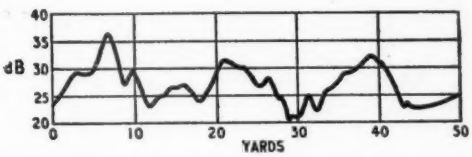


Fig. 3. Local variations in signal strength on Band V caused by proximity of buildings.

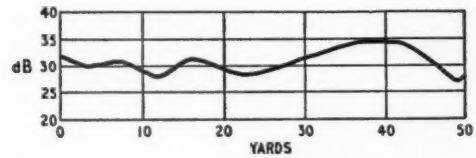


Fig. 4. Local variations in Band-V signal strength in same locality as Fig. 3.

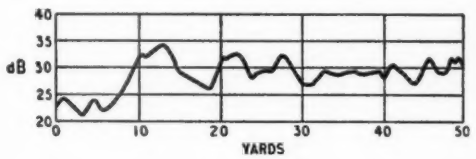
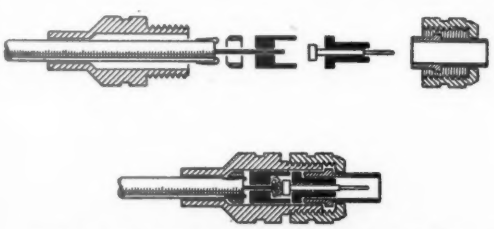


Fig. 5. Local variations in Band-III signal strength in same locality as Fig. 3.

Sub-miniature Plugs and Sockets

A RANGE of tiny coaxial plugs and sockets, which rightly justify the description sub-miniature as they are designed to take a coaxial cable only ⅛in in diameter over the outer polythene insulation, is now obtainable from Sales Service, Pathway, Radlett, Herts. They are known as "Micro" connectors. The plug part of the connector, which is made of nickel-plated brass, measures just under ⅜in long and ⅛in diameter overall. As shown in the exploded drawing, the plug consists of five parts, and this drawing shows also the method of assembling the cable.

There is also a moulded-type plug connector in which the outer insulation forms an integral part of the cable insulation. These are normally supplied with a cable of specific length and with a plug at one or at both ends, normal lengths of cable being 13in, 3ft or 3yd. Other lengths of cable with moulded-plug terminations can be supplied to special order.



Exploded and assembled sketches of the Sales Service "Micro" coaxial connector.

All connectors are rated for 250V working and a loading of 1A. The samples examined had ebonite insulation and thus primarily suitable for use at a.f. A new series with p.t.f.e. insulation and polystyrene mouldings will shortly be available and these will cater for v.h.f. and u.h.f. applications.

The socket part is available in several different styles comprising flush-mounting (as shown in our illustration), stand-off mounting with two styles of fixing flanges and upright mounting with what is described as a "bankbush" base.

The connectors embody a "click" location mechanism which provides sufficient lock to secure the plug under all normal conditions of use. Considering the type of connector prices are quite reasonable, sockets cost from 2s 6d to 5s each and the plug 5s 6d. Cellular polythene coaxial cable in 50-Ω and 72-Ω types and measuring ⅛in outside diameter is also available. The capacitance is 30pF/ft and the attenuation about 12dB per 100ft at 200 Mc/s.

"The Magnetodynamic Pickup." We regret that the sensitivity of this pickup was given, on p. 142 of the March issue, as 44 mV/cm/sec. This should, of course, have been 4 mV/cm/sec

WORLD OF WIRELESS

N.P.L. Reorganization

CHANGES in the organization affecting the work undertaken by four sections of the National Physical Laboratory are announced by the Department of Scientific & Industrial Research. The work previously carried out by the Divisions of Electricity, Metrology and Physics and in the Test House, will in future be undertaken by three new divisions to be known as Standards, Applied Physics and Basic Physics.

The Standards Division will be responsible for all fundamental work on standards of length, mass and time, of electrical and magnetic quantities and also of temperature. Basically it will consist of the present Metrology Division, expanded to include certain work on standards now carried out in the Electricity and Physics Divisions. The superintendent will be Dr. H. Barrell, at present in charge of the Metrology Division.

The Applied Physics Division will be responsible in general for work in the field of classical physics of fairly immediate value to industry (but excluding optics, all of which will continue to be done in the Light Division). The principal areas covered will be electrotechnics, acoustics, heat and radiology. Test House will become an integral part of this division, but will preserve its identity under H. Bowley. The superintendent of the Applied Physics Division will be Dr. B. Wheeler Robinson, in charge of the present Physics Division.

The Basic Physics Division will be responsible for pioneering developments in certain branches of non-nuclear physics which have potential industrial applications in the less immediate future. The post of superintendent has yet to be filled.

Receiver Sales

COMPARATIVE sales figures for domestic receivers for the past three years, issued by the British Radio Equipment Manufacturers' Association, show that the 1957 sales of both sound receivers and radiograms were up by 18% on the previous year. Television receiver sales were down by 3% in comparison with 1956 but up 8% compared with 1955. As the table shows the industry's overall sales have increased each year.

	1955	1956	1957
Television	1.335 M	1.484 M	1.439 M
Sound-only	1.048 M	0.982 M	1.162 M
Radiogramophones	0.269 M	0.212 M	0.250 M
Total sales	2.652 M	2.678 M	2.851 M

The figures for January this year show an 11% increase in television sales compared with last January. Sound receivers show a 3% decrease and radiogramophones a 26% decrease. The proportion of hire-purchase sales for each class of receiver was the lowest for over a year.

Siemens' Centenary

AS part of the celebrations to mark the 100th anniversary of the formation of the Siemens organization in this country, Dr. J. N. Aldington, managing director of Siemens Edison Swan, Ltd., delivered a centenary lecture on 100 years of electrical engineering to an audience of 2,400 in the Central Hall, Westminster, on March 5th. There was also a centenary dinner, attended by 1,200, on March 6th.

"Siemens Brothers 1858-1958" is the title of a book commissioned by the board of directors dealing with the history of the British company, which was originally part of the Siemens & Halske organization in Germany. The 280-page book, written by J. D. Scott, is published by Weidenfeld & Nicolson, price 35s.

To mark the centenary the Science Museum, South Kensington, has set up a Sir William Siemens exhibition, which will remain open for several months.

Trader Year Book

CONDENSED specifications of 250 current television receivers and nearly 400 sound radio receivers are among the many features of the 1958 edition of the "Wireless and Electrical Trader Year Book." Brief specifications of tape recorders and Band III convertors are also given this year and the comprehensive list of intermediate frequencies of sound receivers marketed during the past 10 years has been revised and extended.

The directories of manufacturers, wholesalers and trade names are annual features of this invaluable reference book of the radio and electrical industry. Published by the Trader Publishing Co., Dorset House, Stamford Street, London, S.E.1, it costs 12s 6d (postage 1s 8d).

The Radio Show.—The Radio Industry Council reports that more than 30 manufacturers have signified their interest in the proposal to incorporate an audio section with sound-insulated demonstration rooms at the forthcoming National Radio Show (Earls Court, London, August 27th to September 6th).

R.I.C. Exhibition Technical Committee.—There have been several changes in the composition of the R.I.C. Exhibition Technical Committee. P. D. Canning (Plessey), formerly vice-chairman, takes the place of R. W. Addie as chairman. S. Hill (S.T.C.) is vice-chairman. The other members are W. L. Brown (Belling & Lee), M. A. E. Butler (Philips), M. P. G. Bull (Ekco), R. Chapman (K.B.), A. P. Hale (Belling & Lee), L. A. Isaacson (E.M.I.), T. A. Julian (G.E.C.) and R. W. Murphy (British Radio Corporation).

Broadcast receiving licences in the U.K. at the end of January totalled 14,641,274. Television licences increased during the month by 137,453, bringing the total to 7,898,247. Sound-only licences, including 327,266 for car radio, totalled 6,743,027.

Electronic Engineering Association.—The words "Radio Communication" have been dropped from the title of the R.C.E.E.A. so that in future it will be known as the Electronic Engineering Association. The council for 1958 consists of the following representatives of member firms: F. S. Mockford (Marconi's), chairman; V. M. Roberts (B.T.H.), vice-chairman; F. J. Dellar (Cossor), C. H. T. Johnson (Decca Radar), F. J. Preston (E.M.I.), J. N. Toothill (Ferranti), C. G. White (Kelvin & Hughes), L. H. J. Phillips (Metropolitan-Vickers), R. R. C. Rankin (Mullard), K. S. Davies (Murphy), P. D. Canning (Plessey) and L. T. Hinton (S.T.C.). The new chairman of the Association's General Technical Committee is E. S. Hall (B.T.H.), with E. P. Fairbairn (G.E.C.) as vice-chairman.

Mechanical Handling.—Among the 350 or so exhibitors at the Mechanical Handling Exhibition, which opens at Earls Court, London, on May 7th for 11 days, are seven firms showing electronic and electrical control equipment. They are B.T.H., Cass & Phillip, E.M.S. Electrical Products, English Electric, Ignanic Electric, Metropolitan-Vickers, and Sharp Control Gear. The exhibition, the 6th organized by our associate journal *Mechanical Handling*, will for the first time include overseas exhibitors. Tickets for admission to the exhibition and convention are obtainable free from *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

Third Production Exhibition, sponsored by the Institution of Production Engineers, opens on May 12th at Olympia, London. Among the speakers at the Conference organized in connection with the exhibition will be Dr. F. H. George of Bristol University, who will deal with cybernetics (May 15th) and Dr. F. Koenigsberger, Manchester College of Science and Technology, who will discuss the design of machines for electronic control (May 16th). The show closes on May 21st.

Douglas, Isle of Man, v.h.f. station, which has been transmitting experimentally since before Christmas, was brought into regular service on March 9th. The transmitter radiates the Home Service only on 92.8 Mc/s with an e.r.p. of 6kW.

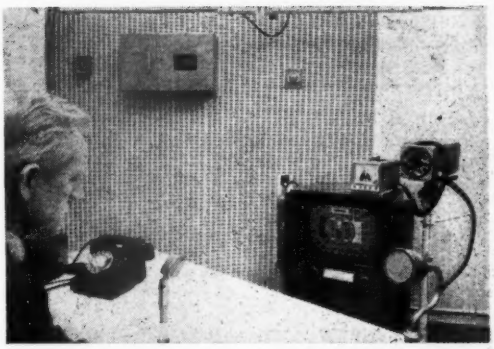
I.E.E. Scholarships.—Seven research and graduate scholarships (valued at from £100 to £500 p.a.) and eight student scholarships (£25-£200) are being offered by the I.E.E. this year. Conditions governing the awards, and application forms are obtainable from the I.E.E., Savoy Place, London, W.C.2. Applications for student scholarships must be received by May 1st and for graduate and research scholarships by June 2nd.

High-Quality Reproduction.—For the third year the Northern Polytechnic (Holloway, London, N.7) has arranged a series of ten lecture-demonstrations on high-quality sound reproduction. The two-hour lectures will be given each Tuesday from April 29th at 6.30. Admission is limited to 150. Further details are obtainable from J. C. G. Gilbert, head of the Polytechnic's department of telecommunications.

Subscription TV.—Rediffusion, Ltd., announce that the arrangements between themselves and Skiatron International Corp., of America, referred to on page 2 of our January issue, have not been brought into force.

Antarctic Communications.—During their trans-Antarctic journey Dr. Fuchs and his party carried two Army Type C12 sets manufactured by Pye Telecommunications.

"Portable Transistor Receiver."—A reprint of this constructional article which appeared in our May and July issues last year, is now available from our publishers. The reprint, which also includes the further notes published in the September issue, costs 2s 6d.



UNATTENDED TV STUDIO.—The camera and lights in this studio at Westminster are controlled from Alexandra Palace (the News Centre) eight miles away. It is used for on-the-spot reports by the B.B.C.'s Parliamentary correspondents. The speaker can see himself in the monitor on top of the receiver which shows the transmitted picture.

"Language and Speech."—A new quarterly journal is to appear in April under this title. Under the editorship of Dr. D. B. Fry, of the department of phonetics, University College, London, it will cover psychological, physiological, statistical and technical aspects of research in speech and language.

Standard Frequency Transmissions.—A new edition of "MSF," the pamphlet giving the schedule of standard frequency transmissions from the Post Office station at Rugby, has been issued by the Department of Scientific and Industrial Research.

Abstracts and References.—Over 4,000 abstracts from and references to articles in the world's technical press were published in *Electronic & Radio Engineer* last year. The annual index to this regular monthly feature of our sister journal costs 2s 6d.

CLUB NEWS

Bexleyheath.—The North Kent Radio Society meets on alternate Thursdays at 7.30 at the Congregational Hall, Chapel Road. On April 10th C. Leal (G3ISX) will speak on "An approach to aerials for the beginner." Sec.: D. W. Wooderson, 39, Woolwich Road, Bexleyheath.

Bradford.—"Oscilloscope interpretation" is the title of the talk to be given by G. F. Craven to members of the Bradford Amateur Radio Society on April 15th. A fortnight later A. Walker (G3DAR) will speak about single sideband. The club meets at 7.30 at Cambridge House, 66, Little Horton Lane, Bradford. Sec.: D. M. Pratt (G3KEP), 27, Woodlands Grove, Cottingley, Bingley.

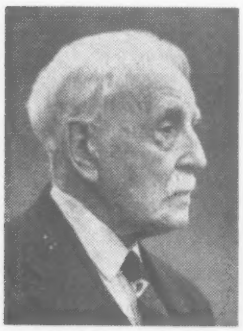
Leicester.—Meetings of the Leicester Amateur Radio Society are held each Monday at 7.30 at Old Hall Farm, Braunstone Lane, Leicester. At the meeting on April 14th P. G. Goadby (G3MCP) will deal with the "Cub" transmitter and on the 28th R. G. Frisby (G2CFC) will discuss aerials. Sec.: P. G. Goadby, 535, Welford Road, Leicester.

North Midland Mobile Rally is being organized jointly by the Midland Amateur Radio Society and Stoke Radio Society for April 20th. It will be held at Trentham Gardens (between Stoke and Stafford). Particulars are obtainable from P. G. Turton, 2, Holloway Head, Birmingham, 1.

Sidcup.—At the meeting of the Cray Valley Radio Club at 8.0 on April 22nd at the Station Hotel, Sidcup, C. Burgess will deal with some aspects of directional aerial design. Sec.: S. W. Coursey (G3JJC), 49, Dulverton Road, New Eltham, London, S.E.9.

Personalities

Sir James Swinburne, Bart., F.R.S., who celebrated his 100th birthday on February 28th, was chairman of Bakelite, Ltd., until his retirement in 1948. He is now honorary president of the company. A consultant electrical engineer by profession, he turned his attention to the development of synthetic resins and in 1910 formed Damard Lacquer Co., which in 1926 became Bakelite, Ltd. Sir James was president of the I.E.E. in 1902.



SIR JAMES SWINBURNE

W. WOODS-HILL

W. Woods-Hill, contributor of a number of articles to *Wireless World* on computer techniques, has joined the Microcell Group as manager of computer developments. He was previously manager of the calculator research laboratories of the British Tabulating Machines Co. He spent several years in R.A.F. radar and radio development units during the war and was at one time liaison officer attached to the French air force during the installation of its radio school at Auxerre, Yonne. Mr. Woods-Hill operates amateur station G4JV.

Edward Lee, M.Sc., Ph.D., director of operational research in the Royal Naval Scientific Service for the past three years, has been appointed to the newly-created post of deputy director of the Research Council of the D.S.I.R. Dr. Lee, who will take the main responsibility for work in the National Physical Laboratory concerned with immediate demands from industry, joined the staff at the Admiralty Research Laboratory in 1939.

F. S. Mockford, re-elected for his third term of office as chairman of the R.C.E.E.A. (now re-named the Electronics Engineering Association), has been commercial director of Marconi's Wireless Telegraph Co. since 1947. He is also a director of Scanners, Ltd. Before joining Marconi's in 1930 he was for some years in charge of radio at Croydon airport.

Dr. John Douce, of Manchester University, has been retained by Servomex Controls, Ltd., as consultant to advise them on theoretical problems arising in the field of non-linear control systems, and systems subject to random fluctations.

W. J. Lloyd, B.Sc., A.M.I.E.E., has joined Short & Mason, Ltd., the scientific instrument manufacturers, as general manager. He was at one time in the scientific instrument division of Sunvic Controls, Ltd., and was until recently sales manager of Technograph Electronic Products.

W. R. Fletcher, B.Sc.(Eng.), A.M.I.E.E., has been appointed Regional Engineer, B.B.C. North Region, in succession to **B. H. Vernon**, who has retired owing to ill-health after nearly 35 years' service with the Corporation. Mr. Fletcher joined the Engineering Division of the B.B.C. in 1936 and has served at a number of stations. In 1949 he was seconded from the B.B.C. to serve as chief engineer of Radio Ceylon, and last year was appointed resident engineer at the British Far Eastern Broadcasting Station near Singapore.

B. A. Hensler, who is appointed to the board of Siemens Edison Swan, Ltd., joined Siemens Brothers in 1929 and throughout the war was concerned with production control of radar calculator equipment and technical liaison work on airborne and other types of radar. He became general manager and chief engineer of Siemens' telephone branch in 1954 and since the merger of Siemens and Edison Swan has been managing director of Siemens Edison Swan (Export), Ltd.

With the completion of the merger of Siemens and Edison Swan the company was split up into a number of product divisions each of which is to have a chief engineer. **T. H. Partridge**, A.C.G.I., D.I.C., A.M.I.E.E., who was chief engineer of the marine division of Siemens Bros., has been appointed to the same post in the new company. He had been with Siemens since 1929 where he was for some years in charge of the radio division. He is a member of the C.C.I.R. study group concerned with operational-technical problems. **J. A. Pim**, B.Sc.(Eng), Ph.D., M.I.E.E., is chief engineer of the telecommunication transmission division. After graduating at University College, London, he joined the G.E.C. and in 1942 went to the R.A.E., Farnborough. After the war he returned to University College to work for his Ph.D. Dr. Pim joined Siemens in 1948 and in 1954 became head of the line transmission laboratory at Woolwich. **F. Sibbald**, B.A.(Eng.), is chief engineer of the company's Tottenham Works where he is responsible for the special products department and the radio components department. Prior to joining the company last year he was engineer in charge of designs at the E.M.I. Greenford establishment.

R. W. Elliott, D.F.H., Grad.I.E.E., who has been with Belling & Lee for five years, has become senior technical representative in succession to **P. A. Clayton**, who is now sales manager of Amphenol (Great Britain), Ltd. Mr. Elliott was formerly on the research and development staffs of Decca Radar and Elliott Brothers.

R. W. ELLIOTT

D. H. W. BUSBY

D. H. W. Busby has joined Beam-Echo, Ltd. the Witham, Essex, manufacturers of Avantic sound equipment, as chief engineer. He was previously in Mullard's application research laboratory, where he was engaged on the development of audio-frequency equipment.

W. Williamson, assistant inspector of wireless telegraphy, has retired from the Post Office after nearly 46 years in telecommunications. He had served at a number of Post Office transmitting and receiving stations, first as an operator and subsequently in administrative posts. After the last war he was concerned with the re-organization of coast radio stations. Recently he has been responsible for the P.M.G. certificate examinations.

H. J. H. WASSELL

H. J. H. Wassell, O.B.E., B.Sc., chief radar engineer of Marconi's since 1955, has been appointed manager of the company's newly created test department. He has been with Marconi's since graduating from Birmingham University in 1929. He was for some years chief of the transmitter development group. The new chief radar engineer is **J. K. Todd,** M.A. (Cantab.), A.M.I.E.E., who joined Marconi's in 1937. He has been chief of the missile radar research group since 1956.

L. Newnham, B.Sc., the new president of the R.S.G.B. has been closely associated with technical education throughout his teaching career and was for some time on the staff of the R.A.F. Radio School, Cranwell. He has been a licensed operator since 1926, his present call being G6NZ. Mr. Newnham is at present headmaster of Eastney Secondary School, Portsmouth.

G. D. Clifford completed 21 years as secretary of the British Institution of Radio Engineers on March 3rd. Until 1944 he acted in an honorary capacity. For some years before joining the staff of the Institution he was a recording engineer with the Columbia Graphophone Co. and also a part-time teacher of radio theory. Among the many committees on which he represents the Institution is the Parliamentary and Scientific Committee of which he has been a member since 1940.

K. Short, D.L.C.(Hons.), A.M.I.E.E., for many years with Truvox, recently formed his own company, Recording Devices, Ltd., to manufacture tape recording equipment and accessories. The company is initially marketing an Austrian tape recorder, the Stuzzi Mambo. Mr. Short left Truvox, of which he had been chief engineer and technical director, in 1956, and was for 15 months director of production with British Communications Corporation (an associate company) from which he resigned last August.

Dennis G. Packman, appointed chief engineer of Tyne Tees Television, Ltd., programme contractors for the I.T.A. North East England transmitter, was with the B.B.C. from 1944-1955. He then joined Central Rediffusion Services, Ltd., as an engineer in the television department. He became head of the department a few months ago. He is 30.

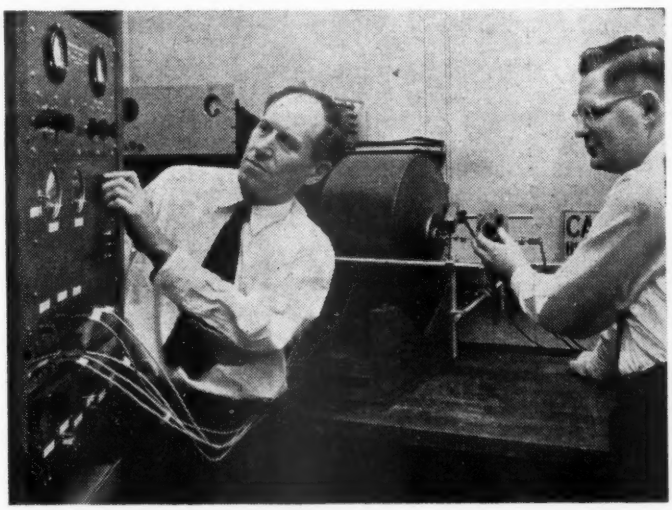
N. G. Worster, A.M.I.E.E., is appointed chief development engineer of Measuring Instruments (Pullin), Ltd. He was previously with S. Smith & Son (England), Ltd.

OUR AUTHORS

J. N. Barry, M.Sc., who, with G. W. Secker, discusses the use of transistors in television receivers in this issue, joined the G.E.C. Research Laboratories in 1946 after a year at R.A.E., Farnborough. He is at present engaged in the application of semi-conductor devices to electronic telephone exchanges, having previously been concerned with their uses in domestic entertainment equipment. He is 32. **G. W. Secker** has worked on the application of semi-conductors in sound and television equipment since joining the G.E.C. Research Laboratories in 1953. After war service as a wireless operator-mechanic in the R.A.F. he joined the Communications Branch of the Home Office where he was concerned with the design and installation of police v.h.f. equipment.

D. J. Collins, B.Sc.(Eng.), A.M.I.E.E., one of the authors of "Stabilized E.H.T. Unit," has been with Solartron Research and Development since 1952. For the previous five years he was with E.M.I. Engineering Development, where for three years he worked on guided weapon projects. He obtained his London University engineering degree in 1950, after a part-time course at Northampton Polytechnic. His co-author **J. E. Smith,** B.Sc., joined Solartron in 1956. After obtaining his degree from Durham University in 1952 he did his national service as an "electrical" officer in the navy and then went to Decca Radar for two years.

J. R. G. Twisleton, B.Sc., A.M.I.E.E., contributor of the note on p. 193. has been in the B.T.H. Research Laboratory since graduating from Leeds University in 1949. He has been working on the development of microwave valves and his interest in exponential horns, about which he writes in this issue, is purely a spare-time activity.



***Dr. Rudolf Kompfner,** who came to this country from Austria in 1934 and since 1952 has been in the U.S.A., is now director of electronics and radio research at the Bell Telephone Laboratories, New Jersey. From the end of the war, during which he was at Birmingham University, until going to the U.S.A. he was in the Clarendon Laboratory, Oxford. Dr. Kompfner, originator of the travelling-wave valve which he first described in* W.W. *in November 1946, is here seen (left) with C. F. Hempstead working on a 5-mm backward-wave oscillator.*

News from the Industry

Solartron Electronic Group, which includes seven companies in this country, one in the U.S.A. and another in Italy, had a turnover of over £1M during the year ended last June. In the Group's annual report the chairman, John Bolton, announced the introduction from January 1st of a two-year guarantee on all the company's equipment.

V.H.F. Transistors. — Production at the recently completed Swindon factory of Semiconductors, Ltd., will begin by the middle of this year with germanium surface-barrier transistors for operation in the 30 to 90 Mc/s range and micro-alloy diffused transistors for operation up to 500 Mc/s. Later this year silicon surface-alloy transistors will be made specifically for requirements involving high-temperature operation.

Decca House, 9, Albert Embankment, London, S.E.11, is the new headquarters of the Decca Group of companies (Record, Radar and Navigator). The telephone number is unchanged (Reliance 8111). Decca Radio & Television will remain at 1-3, Brixton Road, London, S.W.9, but with a new telephone number (Reliance 6011).

Instrument Shows. — Rohde & Schwarz, Narda, and Cascade should not have been included among the exhibitors at the International Instruments Show given in our last issue. Their agents, Aveley Electric, are, however, exhibiting their equipment at the Instruments, Electronics and Automation Exhibition.

Radio Heaters, Ltd., supplied a modified Radyne heater to provide the r.f. voltage to ionize heavy hydrogen gas in ZETA described last month.

Soundrite, Ltd., of 83, New Bond Street, London, W.1, have been appointed sole U.K. distributors and agents for Altec Lansing Corp., the well-known microphone manufacturers, and Stancil Hoffman Corp., makers of specialized recording equipment, both of California.

Partridge Transformers, Ltd., have not moved although their address has been changed to Roebuck Road, Chessington (not Tolworth), because of new Post Office sorting arrangements in the area.

R. B. Pullin & Co., Ltd., have opened a new six-storey factory, providing a floor space of 70,000 square feet, at their Phœnix Works, Brentford, Middlesex.

Rank-Cintel is the new name of **Cinema-Television, Ltd.,** a member of the Rank group of companies.

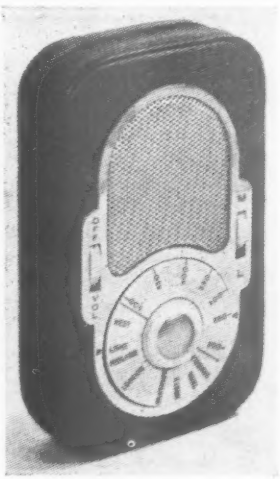
Bendix. — As announced last month, Elliott Brothers have discontinued the sale and servicing of American-made Bendix equipment. Field Aircraft Services, Ltd. (72, Wigmore Street, London, W.1), one of the Hunting-Clan group of companies, have been appointed sales and servicing representatives of the Bendix Aviation Corp. in the U.K. Field's have now opened a new radar and radio centre at London airport.

Cawkell Research & Electronics, Ltd., 6-8, Victory Arcade, Southall, Middlesex, has been formed to extend the activities of the former A. E. Cawkell, electronic engineers, of the same address. (Tel.: Southall 3702.)

Electrical Remote Control Co., manufacturers of low-voltage soldering irons, relays and control equipment, have moved to a new factory on the industrial estate of Tye Green, Harlow New Town, Essex (Tel.: Harlow 24032).

Woden Transformer Co.'s extensions to their factory at Bilston, Staffs., will add a further 20,000 square feet of floor space.

Ariel Sound, Ltd., have moved from Paddington to North London Iron Works, Wenlock Road, London, N.1 (Tel.: Clerkenwell 7184).



PERSONAL PORTABLE presented to H.M. The Queen by the Radio Industry Council. Specially made by Roberts Radio, the transistor receiver covers both the long- and medium-wave bands. The set, measuring 6½in x 3¾in x 1¼in, is in a red leather zip-fastened case.

OVERSEAS TRADE

A record figure for January exports is announced by the Radio Industry Council. The month's total of £3.78M was over half a million pounds more than the January 1957 figure.

Industries Group Sales, Ltd., was recently set up with offices at 7 Rugby Street, London, W.C.1, to act as an "extended selling organization," especially in Eastern Europe and China, on behalf of a cross-section of British industry. It is proposed to open an office in Warsaw. Among the firms in the radio and electronics field who have joined the enterprise are Advance Components, Aerialite, Ardente, Dulci, Duratube & Wire, E.M.I. Electronics, Fielden, Murphy, Racal, Radiovisor, Short Bros. & Harland, Winston Electronics.

Canadian Visit.—A team of seven senior executives from member firms of the Scientific Instrument Manufacturers' Association, led by L. A. Woodhead (Cossor Instruments) is on a goodwill visit to Canada. The other members of the team are D. A. Pitman (Electronic Instruments), P. Schilling (Stanton Instruments), V. A. Sheridan (British Physical Laboratories), D. R. Stanley (Hilger & Watts), W. H. Storey (Unicam Instruments), J. R. Waite (Oertling).

Radio *v* Rustlers.—A v.h.f. radiotelephone system linking 14 police posts with a central headquarters has been installed in the Karamoja district of Uganda to assist in combating the sporadic raids of local tribes on the herds of neighbouring villages. The system is a further extension of the country-wide h.f. and v.h.f. network installed by Marconi's for the Uganda police during the past four years.

Greek Television.—The Hellenic National Broadcasting Institute is seeking tenders for the supply and installation of a central television transmitting station near Athens. The transmitter is for operation in Band III on the 625-line standard with f.m. sound. The specification (reference ESB/2839/58) is obtainable from the B.o.T. Export Services Branch, Lacon House, Theobalds Road, London, W.C.1.

High-Fidelity Equipment.—J. M. Feiring A/S, Lilletorvet 1, Oslo, Norway, are interested in obtaining the representation of United Kingdom manufacturers of microphones, loudspeakers, amplifiers and pre-amplifiers.

New bumper edition

of the

BRIMAR

RADIO VALVE & TELETUBE

MANUAL

336 pages

covering:

VALVE AND TELETUBE DATA

SPECIAL COMPONENTS AND CIRCUITRY

- Summary of Current Types for New Equipment.
- Valve ratings and base connections of nearly 300 valves and Teletubes including the Brimar "T" Range of Special Quality Valves and S.T.C. Special Valves.
- Information on Sentercel Selenium Rectifiers including contact cooled types and on Germanium Diodes, Transistors, High Grade Resistors and Brimistors.
- Circuit Section modernised and greatly increased to include Transistor Circuits.
- Radio Engineering Formulae.
- Information on Band I, 2 and 3 and Amateur Transmitting Wavebands.
- Brimarize Section and up-to-date Substitution List of American Types.
- Equivalents to C.V. Nos.

NO.7 EDITION

PRICE 6/-

SEND FOR YOUR COPY TO:

The Publicity Department

Standard Telephones and Cables Limited

(Reg. Office: Connaught House, Aldwych, London, W.C.2)

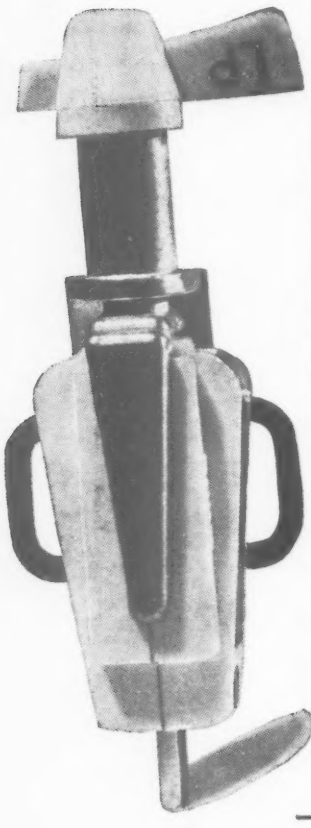
FOOTSCRAY · SIDCUP · KENT · FOOtscray 3333

'The things we do!'

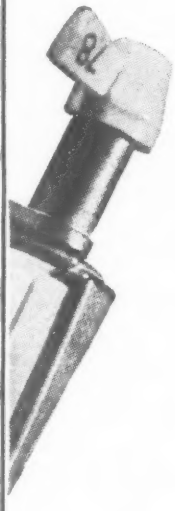
ACOS STEREO

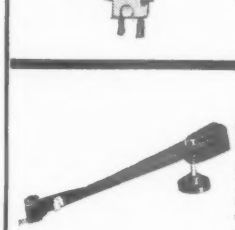
ACOSTEREO
Acos stereophonic pick-up prototypes give superb results, and production models will shortly be available.

'and these just around the corner'



CARTRIDGES
There is a specific Acos cartridge for every application, from small record players to large radiograms and hi-fi installations.





THE BLACK SHADOW
Virtually level response up to 18 kc/s—good appearance—yet most moderately priced. A comprehensive range of other high-quality crystal pick-ups.

X500 STYLI
Sapphire and diamond styli for all current cartridges, individually tested at 500 times magnification.

R.E.C.M.F., April, Stand 30
Audio Fair, April, Room 125

'We Acos cartridges, pick-ups, styli, microphones, do the right thing by your music, by your records, and by your pocket: we always give you faithful sound reproduction at a reasonable cost.'

'And now, as you would expect, we are one of the first in stereophonic sound by introducing AcoStereo.'

CHORUS: **'Come and see us at the R.E.C.M.F. Exhibition. Come and hear what we can do, at the Audio Fair.'**

acos ARE DOING THINGS IN STYLI

COSMOCORD LTD WALTHAM CROSS HERTS · TEL: WALTHAM CROSS 5206 (London subscribers please dial WA4 5206)

Atomic Electrons in Action

From Piccadilly Circus to the Ionosphere

By "CATHODE RAY"

THIS is the stage in our examination of the atom at which it is all too easy to get lost in a maze of detail. Mind you, it is very fascinating detail, and that is all the more reason why we shall have to be resolute in ignoring most of it.

Last month we had the Bohr picture of the atom, with its electrons revolving around the nucleus in clearly defined and easily calculable orbits like planets around the sun, snatched away and replaced by the Schrödinger picture, in which the electron orbits are blurred into hazes of probability. The justification for this apparently unsatisfactory bargain was that either way it is known that the electron can possess only certain fixed amounts of energy and therefore only certain possible orbits, but whereas in the Bohr picture this is just an observed fact with no apparent reason, in the Schrödinger picture it all comes out as a necessary result of the nature of the atom assumed in wave mechanics. The basic equation of wave mechanics indicates the allowable amounts of energy and the shapes and sizes of the corresponding hazes.

Salient Points

If we went into full detail about all the possible electron haze patterns in the atoms of the 92 and more elements—to say nothing of their innumerable compounds—we would soon get bogged down, so I shall try to pick out the main points that concern us:

(1) Each element is identified by the *normal* number of electrons in each of its atoms; i.e., the number needed to neutralize the positive charge of its core or nucleus. (Atoms that lose or gain one or more of their electrons remain the same element, but have a positive or negative electric charge and are called ions.)

(2) Each electron in an atom has a certain amount of energy; partly kinetic (due to its speed of movement around the nucleus) and partly potential (due to its distance from the nucleus).

(3) Its total energy being known within close limits, its position is indefinite (Heisenberg's Uncertainty Principle), but wave mechanics enables on to calculate the relative probability of its instantaneous whereabouts in relation to the nucleus.

(4) There is a series of possible probability patterns or hazes, each identifiable by a four-figure code, and each corresponding to a certain energy level of the electron. The farther from the nucleus (on the average) the greater the energy.

(5) In any atom, not more than one electron can occupy any one of these levels or states at a time (Pauli's Exclusion Principle).

(6) An electron can move suddenly from one level to another, provided it gives out or receives an amount of energy equal to the difference. When there is no incoming energy the electrons settle down into the lowest energy levels, like a "snowstorm" paperweight when it is not being shaken.

Points (1) to (5) are just a recapitulation; (6) is our main subject this month. To illustrate it, let us take a look at a few typical atoms.

We have already glanced at hydrogen, which being No. 1 in the list of elements normally has only one electron. A diagram of the state this electron is normally in—at low temperatures, anyway—showed its most probable distance from the nucleus to be 0.53Å (1Å$=10^{-8}$cm). The distribution of probability is the same in all directions from the nucleus, so the electron can be visualized as a spherical haze around it. The code for this state can be written as 1.0.0. If you object that this is only a three-unit code, I will remind you that the fourth does no more than specify in which of the two possible directions the electron itself spins, and for our present purpose that is not really important.

What *is* important is that besides the fourth number being limited to two alternatives there are certain restrictions on the second and third; namely that the second number must always be less than the first, and the third not greater than the second (but it can be either + or −). So the next state must be 2.0.0. It represents another spherical haze, or rather two concentric hazes, larger and more diffuse than the first. The next, 3.0.0, is three concentric hazes, still larger. But still indicating the relative position-probability of one electron. And so on.

Besides these spherical states, there are those with the second figure higher than 0, represented by what may approximately be described as "dumbbell" shapes in the Schrödinger picture. Although it is possible for the single hydrogen electron to be pushed up into these states, they are of more interest when there are enough electrons to fill them normally, so we shall return to them later.

Electron Energy Change

In the meantime it will be interesting to find out how much the energy of the electron has to change in order to move from one level to another. Planck's law ($E=hf$) then tells us the frequency of the radiation causing or being caused by the change.

Seeing that one reckons the potential energy of a weight in terms of its height above ground level —which is regarded as zero—it might be supposed that the potential energy of the electron is reckoned from the position of the nucleus as zero. But the comparison is wrong; whereas the force of gravity is practically uniform near the earth's surface, a nucleus is so nearly a point charge that the force

between it and an electron is very nearly inversely proportional to the square of the distance between them, so becomes indefinitely large as they approach closely. So it is usual to reckon zero potential (which corresponds with height in the gravitational analogy) as being at an infinite distance from the nucleus. This custom has the slight disadvantage of making all values negative. But since it is only *differences* of potential that matter, the results are the same whatever zero is chosen.

According to the ordinary laws of electricity, the potential at a distance r metres from a charge of q coulombs is

$$\frac{q}{4\pi\epsilon r}$$

where ϵ is the absolute permittivity in m.k.s. units. In this system $1/4\pi\epsilon$ is 9×10^9, and for one electron or hydrogen nucleus q is 1.6×10^{-19} as we have seen. If we put $r=0.53\times10^{-10}$ to represent the lowest energy state of a hydrogen atom, the potential works out at 27 volts. (Surprising, isn't it, that calculations with such fantastically small quantities should yield such an everyday thing as 27 volts!) An electron at that distance therefore has a potential energy of -27 electron-volts (eV). But according to the ordinary laws of mechanics as used in the Bohr picture (and the wave-mechanics picture agrees so far as its haziness allows) the electron has to keep itself from falling by moving around the nucleus at a speed which gives it a kinetic energy equal to $+13.5$eV. So the total energy is -13.5eV.

To remove the electron to an infinite distance from the nucleus one must therefore give it an additional energy of 13.5eV. (Compared with 10^{-10} metre, a very short removal distance by ordinary standards is near enough to infinite for us to be able to say that the electron has been knocked clean out of the atom.) According to Planck's law the frequency f of energy E is E/h, and h (Planck's constant) is 4.1×10^{-15}eV-sec; in this case f is $13.5/(4.1\times10^{-15})=3.3$kMMc/s, which is well into the ultra-violet band of radiation (see Fig. 1). Ordinary light, then, cannot ionize hydrogen atoms—at least, not if they are in their basic state. But another electron travelling fast enough can, by giving up some of its kinetic energy.

Radiation Frequencies

The energies in the other spherical states are found by dividing by n^2, n being the first number in the code, and known, incidentally, as the principal quantum number. So we have -3.4eV, -1.5eV and -0.85eV as the energies in the second, third and fourth states. The change in energy on passing from the first to the second is $-3.4-(-13.5)=10.1$eV. The frequency of radiation needed to bring this about, though lower, is still in the ultra-violet band. Other isolated radiation frequencies are right for pushing electrons up from, say, first to third or fourth, second to fourth, etc., and some of these are obviously in the visible band. So when hydrogen is exposed to radiation covering a broad band of frequencies, it is found on using a spectroscope to examine the light which gets through that there are a number of dark lines, showing these isolated frequencies at which light energy is absorbed by electrons. This is rather like the absorption crevasses one would get on examining with a wobbulator and oscilloscope an electrical circuit with a number of acceptor resonances.

The tendency for electrons to occupy the lowest energy levels soon asserts itself, however, and in fact the "excited" electrons drop back again after a lapse of only about 10^{-8} second, which by comparison makes lightning seem sluggish. In doing so they give up their energy in the form of radiation. Since this radiation has the same frequencies as the original exciting light, it is not very conspicuous; but we remember that atoms can also be excited by bombarding them with electrons. One way of doing this would be to let a little hydrogen into a valve or cathode-ray tube, and the result would soon be visible as a glow inside the tube. It can be done more cheaply and conveniently in a plain tube fitted with cathode and anode. If this glow is examined with a spectroscope, it shows up as a number of bright lines corresponding in frequency to the previous dark ones. All this sort of experimentation was done long before the quantum theory, and it was the agreement between the consequences of the quantum theory and these experimental results which indicated that the theory was on the right lines.

Higher Atomic Numbers

Element No. 2 is also a gas—helium—and its nucleus has of course twice the positive charge of hydrogen, normally neutralized by two satellite electrons. All three particles attract or repel one another, and in ordinary dynamics the problem of three such bodies is notoriously insoluble. Again, wave mechanics comes to the rescue. In the normal or lowest-energy condition the two electrons are both in the 1.0.0 state, and differ only in their opposite directions of spin. In accordance with the rules already mentioned, there can be no other states in which the principal quantum number n is 1. So the two electrons in it complete the $n=1$ community, which is also known as the K shell, or (by us) the first table in the atomic restaurant. The greater charge of the nucleus draws the electrons closer than in the hydrogen atom, and an energy of 24.5eV is needed to remove either of them. This is quite a large amount, so helium electrons are stay-at-homes and show no tendency to flirt with those of other elements. Helium, in fact, does not combine chemically with anything else. Its pair of electrons is a highly stable group, closely bound to the nucleus.

The next element is lithium, with three electrons; and since two of them normally occupy the whole of the $n=1$ (or K) shell the third can get no nearer the nucleus than the $n=2$ (or L) shell. According to the rules already stated, this can include several pairs of electron states: 2.0.0, 2.1.0, 2.1.1 and 2.1.-1. The first of these is our second spherical haze; the other three are non-spherical, but add up to give a spherical group which is very stable. Of the four, the 2.0.0 has the lowest energy, so the third lithium electron is normally found there. The attractive force of the $+3$ charge of the nucleus is considerably reduced by the repulsion of the two inner electrons, so the third electron is relatively loosely bound. Only 5.5eV is required for complete ionization, and quite small amounts for raising it to the slightly higher 2.1 set of levels. Lithium is the lightest of the metals, and readily combines

with other elements, especially those that have one vacancy in a shell.

In atoms of successively higher atomic number, the electrons first fill up the remaining vacancies in the L shell. Since there are four possible subgroups, each with a pair of oppositely-spinning electrons, its total capacity is 8. Added to the 2 in the K shell this makes 10, so we would expect element No. 10 to be another stable one like helium. And we would be right, for it is neon. When this gas is bombarded by electrons, many of its own electrons are made to move between two levels having an energy difference corresponding to the frequency of orange-red light. Other gases have excitation frequencies interpreted by the eye as green and blue. The results of such continuous atomic rearrangements can be studied in Piccadilly Circus and such places, where the bright colours are used to attract the attention of the unsophisticated.

The first two shells being full, element No. 11 must have one electron in the third, and this electron finds itself in the same sort of position as the odd one in lithium, only more so. We would therefore expect it to be a similar sort of element—chemically a very active metal. And so it is. If you drop some of it—sodium—into water you will be left in no doubt about its chemical activity. When its vapour is excited, it has a most notable radiation frequency seen as yellow. Besides being an extremely sensitive test for the presence of sodium—there is enough in almost any speck of dust to give a yellow flash when it passes into a flame, as one can see by looking at a freshly-lit gas fire—it makes an exceptionally efficient form of electric lighting. Since sodium is solid at ordinary temperatures, the discharge has to be started through neon, which is why sodium street lights glow dimly red at first and gradually turn bright yellow as they warm up. Another much used filling is mercury which, being a liquid, vaporizes quicker and gives the familiar bluish light.

The fair sex unite with poster advertisers, shopkeepers and others in deploring lighting of this kind—electrical discharge through gases and vapours—on the ground that it upsets their carefully selected colourings. The reason is clear: such light radiates on only a few isolated frequencies and so is as different as possible from daylight, which covers the whole visible band. Later we shall see how the solution to the objection can be met by taking advantage of other aspects of atomic structure, but in the meantime we may care to note another example of gas excitation—one more clearly within the scope of *Wireless World*. Radiation from the sun includes a large proportion in the ultra-violet band. In certain regions of the upper atmosphere the air atoms are exposed to this, and the energy required to expel their electrons completely (i.e., ionize them) comes within the ultra-violet frequency band, so much of the radiation is absorbed thereby and we are preserved from sunburn of disastrous intensity. Since the electrons and the positive ions they leave behind are both electric charges, this part of the atmosphere—known as the ionosphere—is conductive, and reflects radio waves of not-too-high frequencies, with results we all know.

The succession of elements from neon onwards continues in the same way as those from helium onwards, as can be seen from the Table. That is to

Atomic No.	Symbol	Name	n=1 (K)	n=2 (L)		n=3 (M)			n=4 (N)			
		Element	0	0	1	0	1	2	0	1	2	3
1	H	Hydrogen ...	1									
2	He	Helium ...	2									
3	Li	Lithium ...	2	1								
4	Be	Beryllium ...	2	2								
5	B	Boron ...	2	2	1							
6	C	Carbon ...	2	2	2							
7	N	Nitrogen ...	2	2	3							
8	O	Oxygen ...	2	2	4							
9	F	Fluorine ...	2	2	5							
10	Ne	Neon ...	2	2	6							
11	Na	Sodium ...	2	2	6	1						
12	Mg	Magnesium ...	2	2	6	2						
13	Al	Aluminium ...	2	2	6	2	1					
14	Si	Silicon ...	2	2	6	2	2					
15	P	Phosphorous	2	2	6	2	3					
16	S	Sulphur ...	2	2	6	2	4					
17	Cl	Chlorine ...	2	2	6	2	5					
18	A	Argon ...	2	2	6	2	6					
19	K	Potassium ...	2	2	6	2	6		1			
20	Ca	Calcium ...	2	2	6	2	6		2			
21	Sc	Scandium ...	2	2	6	2	6	1	2			
22	Ti	Titanium ...	2	2	6	2	6	2	2			
23	V	Vanadium ...	2	2	6	2	6	3	2			
24	Cr	Chromium ...	2	2	6	2	6	5	1			
25	Mn	Manganese ...	2	2	6	2	6	5	2			
26	Fe	Iron	2	2	6	2	6	6	2			
27	Co	Cobalt ...	2	2	6	2	6	7	2			
28	Ni	Nickel ...	2	2	6	2	6	8	2			
29	Cu	Copper ...	2	2	6	2	6	10	1			
30	Zn	Zinc ...	2	2	6	2	6	10	2			
31	Ga	Gallium ...	2	2	6	2	6	10	2	1		
32	Ge	Germanium	2	2	6	2	6	10	2	2		
33	As	Arsenic ...	2	2	6	2	6	10	2	3		
34	Se	Selenium ...	2	2	6	2	6	10	2	4		
35	Br	Bromine ...	2	2	6	2	6	10	2	5		
36	Kr	Krypton ...	2	2	6	2	6	10	2	6		

Table of first 36 elements, showing electron groupings in their lowest states. It will be seen that the total number of electrons for each element equals the atomic number.

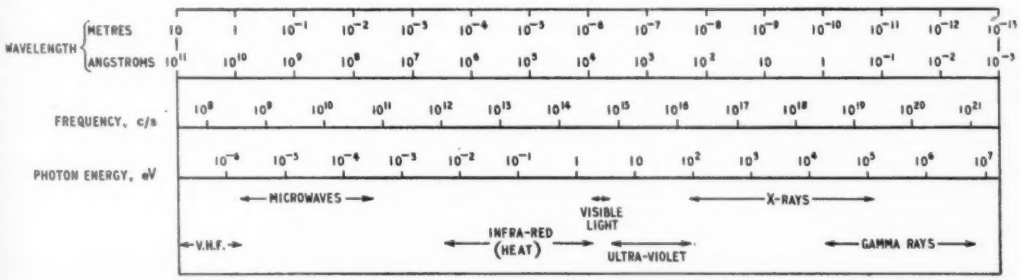


Fig. 1. Spectrum diagram, showing comparative scales of frequency, wavelength and photon energy in the various named bands of radiation. (The limits of most of these bands are not precisely defined, so the markings should be regarded as only approximate.)

say, in No. 12 (magnesium) the first sub-shell (3.0.0) is complete with its two oppositely spinning electrons; the next sub-shell (3.1.0, 3.1.1 and 3.1.-1) holds six electrons, and when complete we have another inert gas—argon. After that, things become a little more catchy. Because $n=3$, the quantum rules tell us that there is another possible group or sub-shell, 3.2.0, 3.2.1, 3.2.2, 3.2-.2, which when complete adds up to a third spherical haze in shell M or 3. This comprises 10 electrons, so to fill all the places in the first three shells requires $2+8+18=28$ electrons. We would therefore expect element No. 28 to be another inert gas. It is, however, the metal nickel!

This is one of those little anomalies that used to worry us when we studied the Periodic Table in chemistry. The reason, we now find, is that the energy level of the fourth spherical series (4.0.0) is lower than those in the third group of the third shell, so electrons start occupying the fourth before the third is complete. This behaviour, as we may imagine, is very upsetting for the managers of atomic restaurants, and is bad enough for us just when we thought we could continue our table of elements from 18 onwards by simply following the rules. But it makes life much more interesting, especially for the engineer, as we can gather merely by reading the names of the elements in this rather unruly group (known as the transition elements) from 19 to 28 inclusive.

After that, things proceed much as they did beginning with sodium. The first three shells are all quite full, and there is one lone electron in the fourth. Again we have a metal, and a very useful one for us—copper. When there are four electrons in this shell we have another interesting element, germanium, in which each of the four is ready to link with one electron each in four other atoms to begin a germanium crystal—the raw material of transistors. Looking at the Table we can see that the corresponding element with one shell fewer is another transistor material—silicon.

By now we are well among the solids, and I must warn you that changing over to them is even more drastic for us than for a baby. Until now we have been assuming that our atoms are far enough apart for their influence on one another to be neglected. That is true of gases, but in order to form a solid the atoms have to pack closely together so that the spacing between them is of the same order as the size of the atoms themselves. That complicates matters a great deal, because there are not only all the forces between the component parts of one atom but between them and all the components of the neighbouring atoms. Some idea of these complications must be had before we can go on to such important things as conduction and emission, and that is so much of a subject that it will have to be left to next time.

Footnote: Having stuck my neck out so far by attempting to translate the more abstruse works of physicists into *Wireless World* language, and especially by attempting to fill in the gaps between their world and ours, I am not surprised if some missiles are attracted. Some readers didn't get through the very first page (89, in the February issue) before protesting about my statement that mass is annihilated when energy is given out by chemical action. What weighted this particular missile was that the example was given to show that accuracy and the Cathode Ray manner are necessarily incompatible. So I would like to make clear that although I do not make myself responsible for the correctness of the theories currently held by the most eminent authorities in their field (it would be a trifle presumptuous if I did!) I do accept responsibility for the correctness with which I report them. So I hope no error will be allowed to pass without comment. I would be grateful, too, to hear of any difficulties that arise. Though I don't undertake to answer all comments individually if they come in a flood, I always correct any definite errors, and often use readers' suggestions.

Fortunately there is no difficulty in quoting the highest authority for the statement about chemical energy, but since it contradicts what we—the old 'uns, anyway—learnt at school, and I offered no explanation, I shall try to bring it in again later.

Commercial Literature

Miniature Hearing Aid of which the main unit is small enough to be worn on the head—behind the ear, fitted to spectacles, as part of a hair-slide or headband—is described in a leaflet from The Belclere Company, P.O. Box 22, 117, High Street, Oxford. It measures $1\frac{1}{2}$in × $\frac{3}{4}$in × $\frac{1}{4}$in and weighs under $1\frac{1}{2}$oz. The four-transistor amplifier is claimed to run for 80 hours continuously on one battery.

Coloured Self-Adhesive Tape made of p.v.c. and available in widths from $\frac{1}{4}$ inch to 1 inch. Electrical data and prices in literature from Smith and Nephew, Bessemer Road, Welwyn Garden City, Herts.

Power Oxide Resistors, composed of metal oxide bonded to porcelain rod, intended to replace smaller types of cement-covered wire-wound resistors. Claimed to be extremely rugged and resistant to mechanical damage and effects of moisture. Values from 10Ω to 20kΩ and ratings of 3 to 8 watts. Details on a leaflet from Welwyn Electrical Laboratories, Bedlington, Northumberland.

Epoxide Resins, notable for good adhesive properties, general toughness and resistance to chemicals. Information sheets on various types, ranging from liquid to solid, and on appropriate hardeners, fillers and diluents, from Bakelite, 12-18, Grosvenor Gardens, London, S.W.1.

Cabinets for standard 19-inch front panels, with "picture frame" front appearance. Various heights from $12\frac{3}{4}$ inches to $20\frac{3}{4}$ inches; depth, 11 inches. Leaflet from Phillips and Bonson, Pond Works, 8, Millfields Road, London, E.5.

Versatile Signal Tracer which can be used to follow r.f., i.f., a.f., oscillator, timebase and other signals without the need for switching or changing the probe. Presence and amplitude of signals is indicated on a "magic eye" and any a.f. component by a loudspeaker. Also a **Transistorized D.C. Voltmeter** with six ranges from 1V f.s.d. to 20kV f.s.d. (another model with nine ranges up to 1000V f.s.d.). Made by Amos of Exeter. Leaflets from RGA Sound Services (Plymouth), 2, Sarnesfield Road, Enfield, Middlesex.

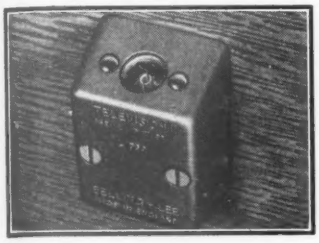
Tea Break Timer closes an electric bell circuit at the beginning and end of a standard period which can be 10, 15, 30, 45 or 60 minutes. It is started by a push-button and resets automatically at the end of the timing cycle. Leaflet from the Electrical Remote Control Company. Distributors are Equipment and Services, Bush Fair, Tye Green, Harlow New Town, Essex.

V.h.f./A.m. Receiver crystal controlled for one channel frequency (up to ten can be arranged to special order) between 30 and 180Mc/s, employing a double superhet circuit and with internal monitor speaker is described in a leaflet from R. E. E. Telecommunications, Greenham Mills Works, Crewkerne, Somerset.

A.C. Mains Voltage Stabilizer using magnetic saturation is described in a leaflet from Mercia Enterprises, Godiva House, Allesley Old Road, Coventry. The "Sabir" load limits are 25 to 250 watts, and the compensation time less than 0.02 seconds. Regulation and total harmonic distortion characteristics are given.

"BELLING-LEE" OUTLET BOXES

for distribution systems



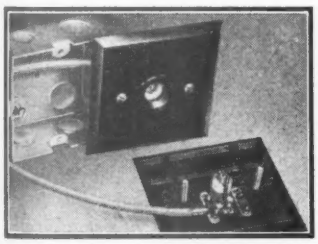
L.1359/18/P.	PADDER NETWORK 18dB attenuation	11/-
L.1359/26/P	PADDER NETWORK, 26dB attenuation	11/-
L.1359/18/T.	TERMINATING NETWORK 18dB attenuation	13/-
L.1359/26/T.	TERMINATING NETWORK 26dB attenuation	13/-

Available with either padder or terminating networks, this outlet box gives correct matching in multi-point installations.

It is produced to two different attenuations—18 and 26 dB—catering for 10 point and 40 point television or VHF/FM amplifiers. In each instance the insertion loss is designed to balance the amplifier gain and prevent receiver interaction.

The die-cast case is bronze finished and, being metal, maintains continuity of screening. The box has provision for coaxial feeders of up to ⅜in. overall diameter to be looped in.

It has certain laboratory and test bench applications. Supplied with wood screws.



COAXIAL OUTLET BOX

Flush mounting L.1311

This socket is designed to fit conduit boxes conforming to the requirements of B.S. 1299 and B.S. 1363.

To facilitate the looping-in of cables a separate terminal post is fitted in each box. There is sufficient space inside for termination or padder networks to be installed, if needed.

Supplied in brown or ivory 7/-

BELLING & LEE LTD

GREAT CAMBRIDGE RD., ENFIELD, MIDDX., ENGLAND

Telephone: Enfield 3322 · Telegrams: Radiobel, Enfield

"BELLING-LEE" NOTES

There are two ways of putting up a television aerial, the more usual is to lash the one thought suitable to the most convenient chimney. In most cases the resulting picture is satisfactory.

In situations where there is a weak signal, either through distance or through being overshadowed, or where there is bad "ghosting," much greater care must be exercised in the selection of the aerial, and in its siting.

Quite apart from the cost of the aerial, the time taken in a difficult location might be many times that of a normal installation, and the viewer must be prepared to foot the bill. It is quite unreasonable to expect a radio dealer to return to the same job time and again without reward.

A rather similar situation is when a car develops some obscure fault, and is taken into the garage time after time in an endeavour to have the trouble solved. You have to pay.

Hampstead is just about ten miles from the Croydon transmitter. On the top of the hill facing south, a wonderful picture is obtained with the simplest aerial, but just over the brow of the hill, six element arrays are required for band III, and in some places we have had to install a double-6 before a satisfactory picture was obtained.

We are just back from the valleys of South Wales, where that sort of thing is commonplace. Only by applying all their skill, can dealers provide a good picture, and sometimes the viewer refuses to pay for the necessary big aerial and labour charges when the job is finished. We cannot help feeling that in a difficult place, the dealer should discuss the whole situation with his customer first. The difference in the cost of material and labour in erecting a three element array and a double-9 is many pounds.

In any easy area, an aerial rigging firm can make a good job of six or eight installations each day, but installations such as we have been describing may each take many man-hours, and have to be costed on this basis.

The "Belling-Lee" double-9 is a magnificent aerial both for gain and "anti-ghosting." One of our engineers, just back with the mobile research unit, from a tour of the valleys above Cardiff, Bristol and Stroud, says that only in one location did the double-9 fail to reduce "ghosting" to acceptable proportions without appreciable loss of signal. He was astonished at its performance.

This double-9 array is the most efficient band III aerial that we have tested, either under laboratory conditions or in the field (or valleys).

At a recent meeting we were asked that, as in one particular locality a six element aerial produced no signal, was it worth while erecting a double-6 or a double-9? The sensible answer is that the difference in gain between a six and a double-6 might be well worth while, but a 4 dB gain over no signal is still nothing. The gain of a "Belling-Lee" double-9 is 8 dB over a 6 which is considerable. The best thing to do is to experiment with the aerial on site, try to get a signal of sorts, then improve it.

But be careful in your choice: there is a double-8 on the market with a gain only equal to our double-6, and a double-10 less than our double-6. The "Belling-Lee" double-9 is the most sensitive band III aerial yet in production.

Aerial Amplifiers

Many people in very bad areas ask if an amplifier would help them. If they can get a good clean picture though weak, the answer is "very probably," but if there is no picture the answer is obviously "no." You cannot amplify nothing, nor is it worth while amplifying a "noisy" picture, you just amplify the noise. One very useful application is where the feeder is exceptionally long. If there is a good clean picture at the bottom of the mast, which is lost at the far end of a long run, this can be recovered by the careful application of an amplifier.

Advertisement of Belling & Lee Ltd., Great Cambridge Rd., Enfield, Middlesex

Written 20th February 1958

MARCONI TELEVISION RECORDING EQUIPMENT

TYPE BD679 RECORDING CHANNEL

16mm film presents a most economical and flexible means of recording television pictures since film costs are low, developing and printing techniques are advanced and a wide range of fine grain film stocks are readily available. Projection, editing, viewing, dubbing and handling are all easily carried out with standard equipment. The Fast Pull-down technique presents great advantages over other systems of recording on film but the mechanical difficulties of moving the film in the short period of frame blanking have hitherto prevented the employment of the technique. These problems have now been successfully overcome by Marconi's.

Features

Exceptionally high picture quality.

Specially developed gearbox enables Fast Pull-down technique to be employed. F.P.D. Mechanism has given over 3,000 hours trouble-free operation.

Pull-down time adjustable, normally set at 2 milliseconds permitting recording of fully interlaced picture. Simple single-lens optical system avoids loss of contrast.

Sound can be recorded on optical track, magnetic stripe or separate synchronous magnetic track.

Conveniently placed input selector switches, monitor and level controls. Sound/Vision cueing device incorporated.

Recording can be made on positive or negative stock of a wide variety, either direct positive, direct negative or reversal. Magazines hold 2,400 ft. (2,000 ft. magnetic stripe) or film may be fed directly into a rapid processor.

MARCONI

COMPLETE SOUND AND TELEVISION BROADCASTING SYSTEMS

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

LB10

Double Tetrode Oscillator

V.H.F. POWER GENERATOR COVERING 150 TO 500Mc/s

By J. H. ANDREAE*, Ph.D. and P. L. JOYCE*

AN oscillator using the Mullard double tetrode valve type QQVO6-40 has been developed for a programme of ultrasonic research. The oscillator was required to have a continuous frequency range from 150 to 300Mc/s and it was to be anode modulated with 3-μsec 3-kV pulses repeated at about 300 p.p.s. This account records preliminary work carried out with the oscillator to test its performance under low-voltage continuous-wave conditions. The frequency range of the oscillator is from 150 to 500Mc/s and numerical values of power and efficiency are given to indicate its capabilities; these figures do not represent the optimum performance of the valve but the details given here may be of interest in connection with the design and construction of similar oscillators.

Construction.—The circuits of the push-pull oscillator are shown in Fig. 1; in circuit (a) "cross-over" feedback is used consisting of small variable capacitances connecting each anode with the opposite grid electrode. In circuit (b) "straight" feedback, in the form of small variable capacitances between each anode and its own grid electrode, is used in conjunction with a resonant grid circuit. Circuit (a) is simpler to operate but is unsatisfactory at frequencies above about 300Mc/s and so circuit (b) is employed at the higher frequencies.

A composite photograph of the oscillator is shown in Fig. 2. This shows the oscillator set up for an output power measurement, while Fig. 3 indicates more clearly the detailed construction of the valve assembly. Alternative lines, coupling coils, plug-in grid circuits and feedback capacitors are shown laid out by the side of the oscillator in Fig. 2. In the foreground can be seen the load resistance, transformer and a.c. meters for power measurement.

The frequency of the oscillator is determined by the length of the main anode line A and this is varied by moving the valve assembly B relative to the fixed short-circuit C by means of the screw D. Power is drawn from the anode line *via* the coupling coil E. This coil can be moved along the carriageway formed by the top of the frame but normally it is situated near to the short-circuited end of the anode line where the magnetic field is a maximum. To vary the length of the anode line the valve assembly is moved rather than the short-circuit so as not to disturb the coupling between the anode line and the coupling coil at every change in oscillator frequency.

Power connections to the oscillator are made *via* the cable F with the exception of the high tension voltage to the anodes which enters through the coaxial cable G. The screened cable F contains four insulated conductors which carry the screen-grid voltage, the heater current, and grid current to the external meters; the four conductors are numbered (1), (2), (3) and (4), respectively, in Fig. 1 (a).

Anode Lines.—Three separate anode lines have been provided for the oscillator and they are readily interchanged. Connection to the anode pins is *via* two copper strips H (Fig. 3 (b)) which are soldered to copper bushings electrolytically deposited on to the pins. The low-impedance line comprises two parallel strips as shown in Fig. 3 (a). Each strip is made from 1in × $\frac{1}{8}$in silver-plated brass. Because of the length of line

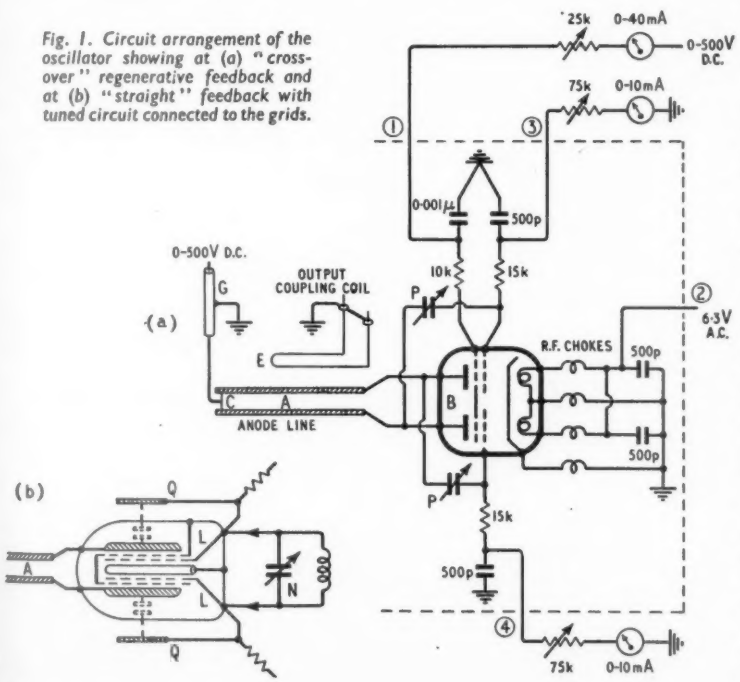


Fig. 1. Circuit arrangement of the oscillator showing at (a) "cross-over" regenerative feedback and at (b) "straight" feedback with tuned circuit connected to the grids.

* Imperial Chemical Industries Ltd., Research Department.

required at the lower frequencies it is made in two halves, one of which can be used alone at the higher frequencies. The separation of the strips is 0.2in, from which the characteristic impedance is calculated to be 75 ohms. Neglecting edge effects:—

$$\text{impedance } Z_o = 337 \frac{\text{separation}}{\text{width}} \text{ ohms}^1 \quad \ldots\ldots \quad (1)$$

The other two lines provided consist of parallel, silver-plated, brass rods, $\frac{3}{8}$in in diameter. The rods are in 3-in lengths which screw into each other so that parts of the lines can be removed at higher frequencies. A medium-impedance line is obtained with these rods at a separation of $\frac{3}{8}$in as shown in Fig. 3 (b), while a high-impedance line is obtained at a separation of $1\frac{1}{2}$in. The characteristic impedance of a parallel-wire line is given by the well-known formula:—

$$Z_o = 276 \log_{10} \frac{\text{separation}}{\text{radius of wire}} \text{ ohms} \quad \ldots\ldots\ldots\ldots \quad (2)$$

which yields a value of 150 ohms for the medium-impedance line, and 250 ohms for the high-impedance line.

In order to calculate the resonant frequencies of the three lines it is necessary to take into account (*a*) the capacitance between the valve anodes, (*b*) the length and characteristic impedance of the anode pins within the valve envelope, (*c*) the length of the connections from the anode pins to the lines, and (*d*) the length of the short-circuiting conductor.

The capacitance between the anodes was measured with the valve *in situ* and found to be exactly 2.0pF. The length of the anode pins within the valve envelope is 2cm and the characteristic impedance of the pins is calculated from formula (2) to be 350 ohms.

The low-impedance line is held right up against the valve envelope so that no allowance need be made for connections from the valve pins to the line; also the short-circuit is of negligible length. Therefore, if the distance measured from the short-circuit to the valve envelope is x cm, the anode resonant circuit comprises a 75-ohm line, x cm long, connected to a 350-ohm line, 2cm long, the latter being terminated by a capacitance of 2pF. A comparison of theoretical curves and experimental points for the 75-ohm line is made in Fig. 4, the former being calculated by means of the transmission line calculator described elsewhere in this issue. The slight divergence between the experimental and theoretical values for longer lengths of the line is probably due to bowing of the line with a consequent increase in effective characteristic impedance.

The medium-impedance line joins the valve pins about 1cm from the valve envelope so that, in calculating the resonant frequency of the anode circuit, the length of the 350-ohm line needs to be increased to 3cm and the length of the 150-ohm line will be $(x-1)$cm. The same short-circuit is used as for the 75-ohm line. A comparison of theory and experiment is given in Fig. 4.

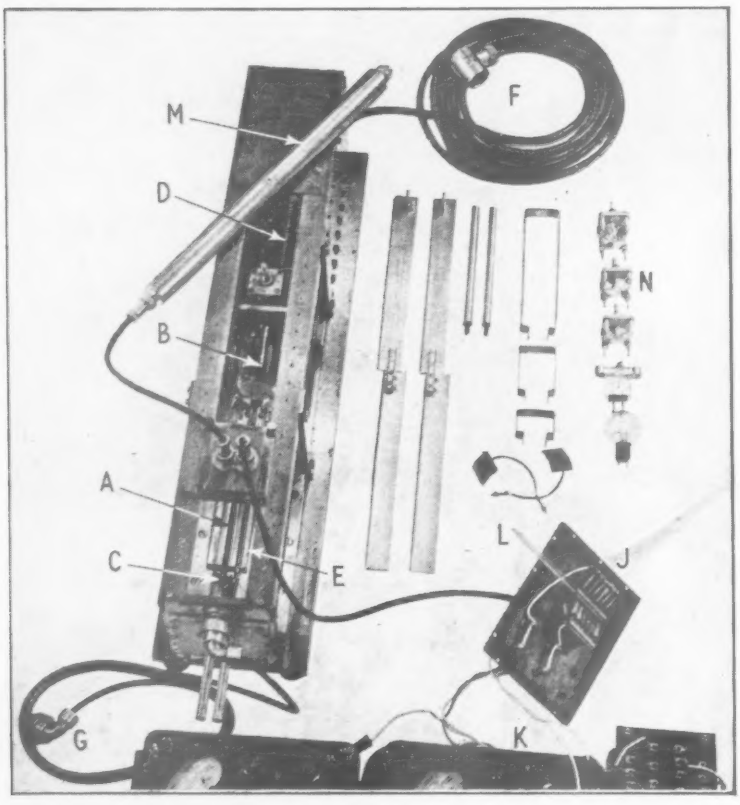


Fig. 2. The oscillator set up for power output measurements and including spare anode lines and grid circuit elements. Lettering enables components to be identified in the circuits of Fig. 1.

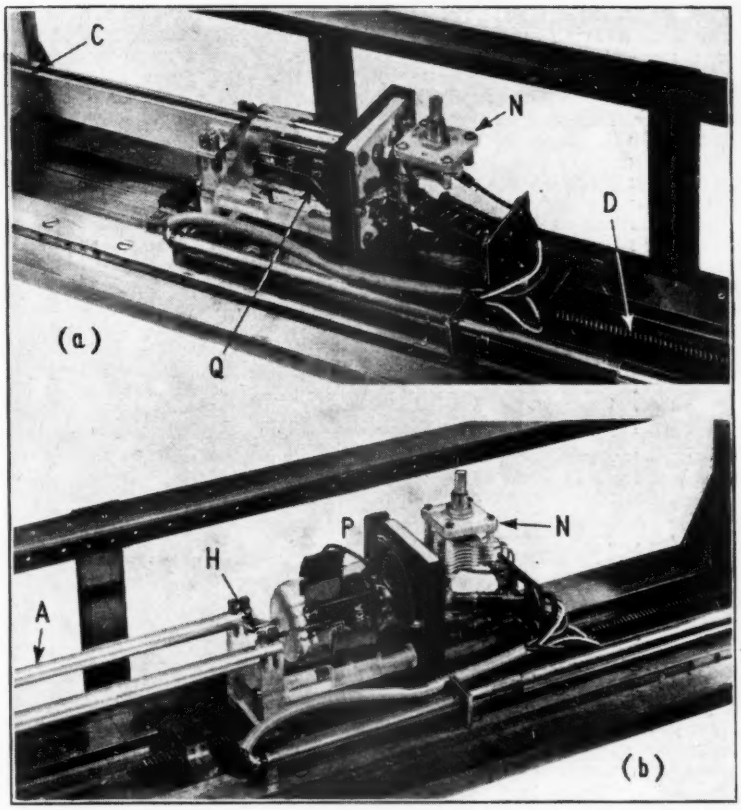
Because of the large separation of the conductors in the 250-ohm line the lengths of the connections from the valve pins to the line and the length of the short-circuit are appreciable. In order to allow for these additional lengths of conductor, 2cm are added to the length of the line and it can be seen from Fig. 4 that this reasonable estimate results in good agreement between theory and experiment.

The experimental points shown in Fig. 4 illustrate how the frequency range of the oscillator depends on the impedance of the line employed. Other features of the anode circuit will be discussed later in connection with the grid circuit, feedback and power generation.

Grid Circuit. — Two forms of feedback have been used, cross-over feed-

back (P in Fig. 3 (b)) at the lower frequencies and straight feedback (Q in Fig. 3 (a)) at higher frequencies. These are shown in Fig. 1 (a) and (b) respectively. The oscillator does not oscillate satisfactorily with cross-over feedback at frequencies above 300Mc/s and it is thought that this accounts for the definite divergence of the experimental and theoretical values shown in Fig. 4 for this type of feedback at the higher frequencies. On the other hand, with the small feedback capacitances which are used, straight feedback becomes ineffective at frequencies below 300Mc/s.

Below about 200Mc/s cross-over feedback can be employed without a resonant grid circuit unless the maximum power is required from the valve. Otherwise it is necessary to resonate the inter-grid-electrode capacitance and the inductance (L in Fig. 1 (b)) of the grid leads within the valve envelope with an externally added circuit. A measurement of the grid



Above : Fig. 3. Details of the valve assembly, (a) with low-impedance parallel-strip anode line and "straight" feedback capacitators and (b) with wide-spaced line, "crossover" feedback capacitors and tuned circuit.

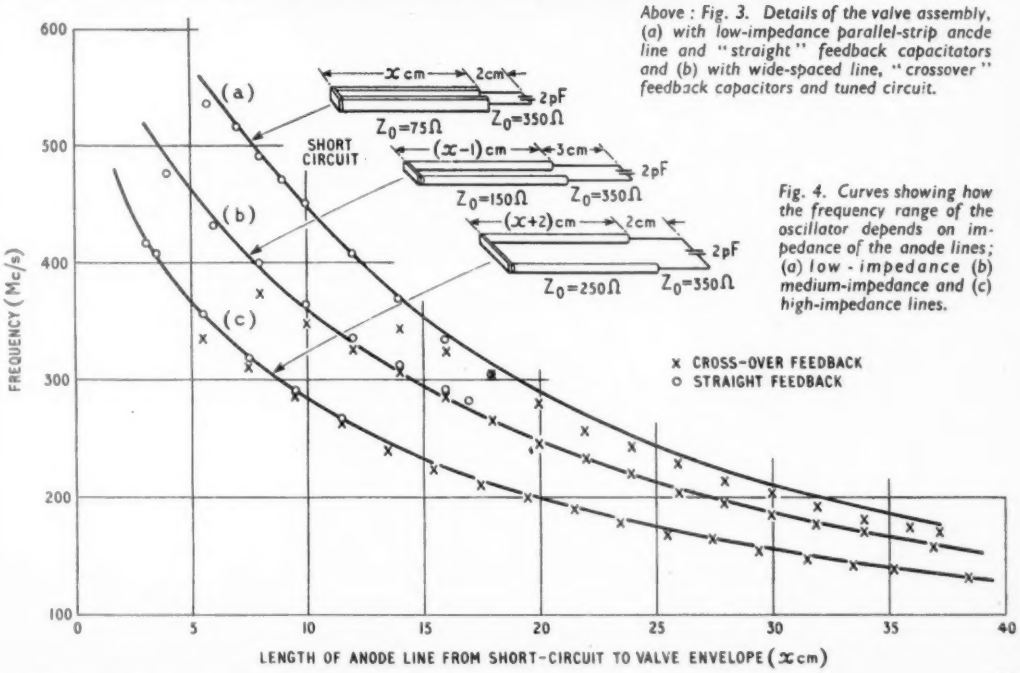


Fig. 4. Curves showing how the frequency range of the oscillator depends on impedance of the anode lines; (a) low-impedance (b) medium-impedance and (c) high-impedance lines.

capacitance gave 5.2pF and an estimate of the inductance of the leads can be obtained by comparing them with a loop of wire 1in in diameter and 0.02in thick. The inductance of such a loop is shown[2] to be 0.1μH. Another estimate can be found by joining the grid terminals on the valve base and by adjusting the frequency of the oscillator for minimum anode current (indicating that the grid circuit is resonant). The frequency at which this occurs is 230Mc/s and it is readily shown that 5.2pF resonates with 0.1μH at about 230Mc/s confirming the previous estimate. Having ascertained the series inductance and capacitance of that part of the grid circuit which is within the valve envelope, the magnitude of the external reactance which must be added at any particular frequency can be computed. A few values are given in the table:—

Mc/s	120	150	180	200	Mc/s	250	300	350	400	450	500
μH	0.238	0.116	0.050	0.022	pF	18.3	6.11	3.44	2.27	1.65	1.25

In order to provide the appropriate grid reactance at all frequencies a series of plug-in capacitor units are employed, some of which are ordinary variable air capacitors and others have parallel coils as well. These can be seen, marked N, in Figs. 1(b), 2 and 3.

Power Generation.—A limited amount of time was spent in studying the power output and efficiency of the oscillator with a view to becoming more familiar with the behaviour of the apparatus. The most important feature which soon became apparent was that the efficiency increased when more power was drawn from the circuit. At the higher frequencies it is very much more difficult to couple an external circuit sufficiently strongly to the anode line to extract the necessary power. For one thing, the anode line becomes a smaller proportion of the anode resonant circuit at the higher frequencies and there is an appreciable voltage drop along the anode pins. Also lower impedance lines have to be used in order to reach the higher frequencies and these are intrinsically more compact and less easy to couple to. Finally, the need for avoiding power losses by skin effect, by poor contacts, by radiation and by absorption in extraneous parts of the circuit, such as the heater circuit, becomes more important at the higher frequencies. Fig. 5 summarises a number of measurements of power and efficiency which were made with the oscillator. These do not represent the optimum values which can be obtained with the valve; in fact it is known[3] that 60 watts can be drawn from an oscillator incorporating this valve and operating at the fixed frequency of 500Mc/s.

Two methods of power transfer and measurement have been used and these are illustrated in Fig. 6 (a) and (b). In the method (a) power is drawn from the anode line by means of an output coupling loop located above the line. It is found that the best results follow from long loops made of copper strip about $\frac{1}{4}$in wide, the separation of the two sides of the loop being about the same as that of the conductors of the anode line. The load resistance consists of a series-parallel combination of 12 cracked-carbon resistors connected as shown in Fig. 6 (a) and giving a terminating resistance of 68 ohms to the coaxial cable from the output coupling loop. The six 0.001-μF capacitors decouple the "earthy" ends of the resistors to the outer conductor of the cable at the radio frequencies while presenting a high impedance path to the 50c/s a.c. calibration circuit. The centre conductor of the coaxial cable from the output coupling loop is joined to a brass tube which forms the common connection of the 12 carbon resistors; the brass tube also acts as a screened holder for a thermometer (L in Fig. 2) which records its temperature. From the view of the load resistance J and part of the calibration circuit K shown in Fig. 2, it can be seen that all r.f. connections are as short as possible to avoid stray inductances. The method of tuning the output coupling circuit has been explained in the literature[4] where a full description may be found. In practice the variable length coaxial line shown in Fig. 6 (a), (M in Fig. 2), is adjusted until a maximum temperature is recorded by the thermometer. The oscillator is then switched off and the a.c. calibration voltage is increased until the same steady temperature is recorded by the thermometer. Invariably the maximum power is obtained when the coupling loop is near the short-circuited end of the anode line and, usually, as the output power is increased the grid circuit requires slight adjustment.

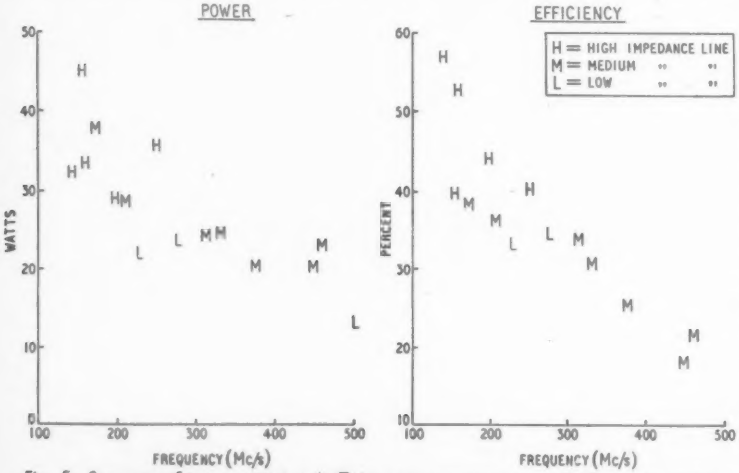


Fig. 5. Summary of power output and efficiency measurements over the frequency range covered by the oscillator.

The slowness of the thermometer method of measuring power makes the adjustment for maximum power difficult and tedious, particularly at the higher frequencies. A good idea of the vigour of the oscillations under any particular conditions can be acquired by holding a small neon lamp near the high-voltage end of the anode line, or near a corresponding part of the output circuit, but this does not provide a quantitative measurement. The combination of a standard, 40-watt, 230-volt lmap and a normal photographic light meter provides a quick and reasonably accurate meas-

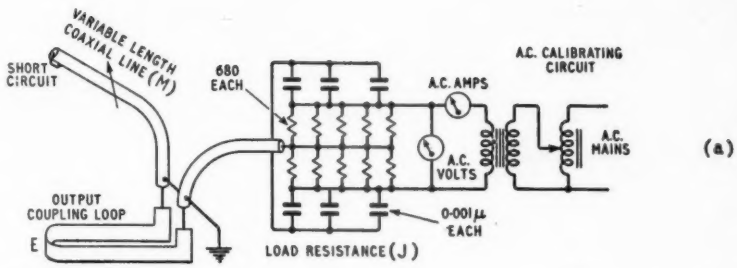
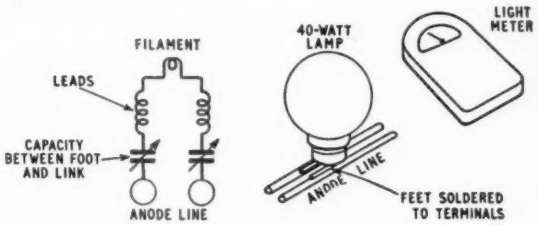


Fig. 6. Two methods of measuring the power output, (a) by means of a coupling loop and a resistance load of known value and (b) by means of a lamp and light meter.

urement of the power available from the oscillator, as illustrated in Fig. 6 (b). Two short thick wires (feet) are soldered to the terminals of the lamp and the latter is supported just above the anode line. The light meter is fixed near the lamp by the same support which holds the lamp so that the two can be moved together. Power is transferred from the high voltage end of the anode line to the lamp *via* the series resonant circuits formed by the inductances of the leads to the filament within the lamp and the capacitances between the feet and the anode line. By moving the lamp and light meter support the capacitances can be adjusted for maximum reading of the light meter, *i.e.*, maximum power from the lamp. Without disturbing the relative positions of the lamp and the light meter the same reading can be obtained with the a.c. calibration circuit (Fig. 6 (a)) connected to the feet of the lamp. The product of current and voltage gives the power



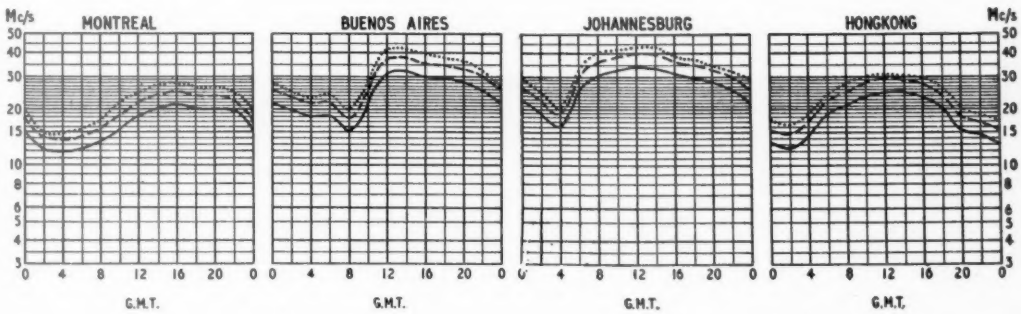
At the lower frequencies it is not feasible to resonate the inductance of the lamp leads with the capacitance between the feet of the lamp and the anode line, but the lamp may be used in place of the load resistance of Fig. 6 (a). The a.c. calibration circuit can be applied, after the oscillator has been switched off, to the end of the variable length of coaxial line in place of the short-circuit. However, it should be noted that the load resistance provides a resistive termination of prescribed value, while the lamp does not.

REFERENCES

[1] Schelkunoff, S. A., "Electromagnetic Waves," p. 243. (D. Van Nostrand, 1947.)
[2] Terman, F. E., "Radio Engineer's Handbook," p. 52. (McGraw-Hill, 1943.)
[3] Private communication from Mullard, Ltd.
[4] Harvard University Radio Research Staff, "Very High Frequency Techniques," p. 380. (McGraw-Hill, 1947.)

SHORT-WAVE CONDITIONS

Prediction for April



THE full curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during April.

Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.

•••••••••• FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME

— — — PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY

——— FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS

Magnetism in Materials

(Concluded from p. 131 of previous issue)

4. Rectangular Hysteresis Loop Materials : Permanent Magnets

By D. H. MARTIN, Ph.D.

THE use of ferromagnetic cores as storage elements in computers and similar devices has created a demand for a rather new kind of material. This must have a coercivity no greater than about 1 oersted, and a hysteresis loop which is as nearly rectangular as possible. A core made of such a material has, in the absence of a magnetic field, two stable states, i.e. the two possible directions of the remanent magnetization. In a digital computer these two states are respectively used to indicate the storage of a "0" or a "1."

An example of the use of cores of this kind is the computer memory, or store, shown in Fig. 22. Information in the form of a series of pulses, representing a "1" when positive and a "0" when negative, is fed into the memory and stored there until required again later in the computation. The method of "writing" a "1" into, say, the core in the third column and second row (labelled 3.2 in Fig. 22) is to pass simultaneous pulses of current through the third vertical wire and the second horizontal wire. Each pulse produces a field which is only slightly larger than half the coercive force, and so only core 3.2, at which *both* pulses appear, is acted upon by a field large enough to reverse its polarization, thereby storing a "1." In order to "read" this "1" at a later time current pulses are again passed through the wires in the third column and the second row but this time in the opposite directions. The polarization of core 3.2 is then reversed and an inductive pulse of e.m.f. is produced in the output winding which threads all the cores, and this indicates that a "1" had in fact been stored there.

The desirability of a rectangular loop will now be clear. If a "0" is stored in a particular core no output pulse is desired when reading, but in practice a small unwanted pulse is produced by the small change in induction from B_r to B_{max}. Small unwanted pulses are also produced, during reading, by all the other cores which are subjected to single current pulses (half H_c). The unwanted signals are smaller the larger the ratio of B_r to B_{max} and only materials for which this ratio is greater than 90% can usefully be employed.

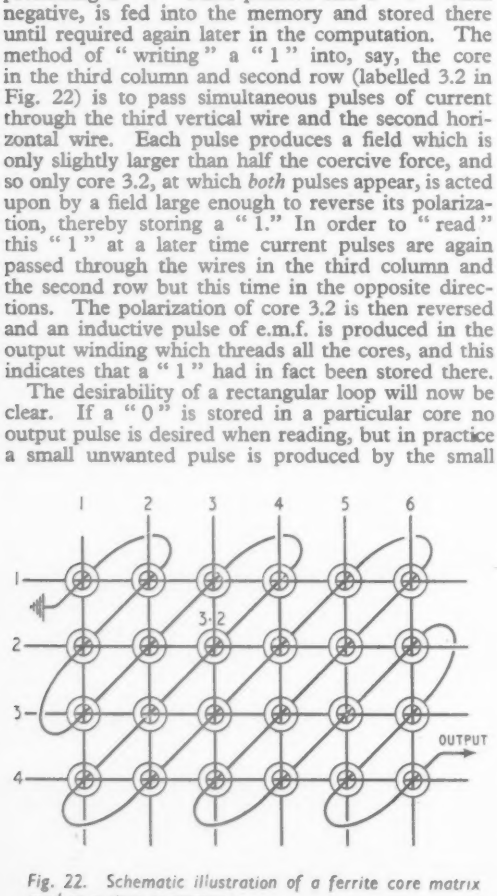


Fig. 22. Schematic illustration of a ferrite core matrix used as a store or memory.

Rectangular-loop materials are also used in the units which perform the arithmetical operations in some computers, in shift registers, magnetic amplifiers and a number of other applications.

The materials most commonly used for the computer applications are certain ferrites which switch in times of the order of 1 microsecond. Short reversal times are attainable with ferrites because their high electrical resistivities mean that eddy current damping of the reversal processes is very small. Ferroxcube D is a commercial magnesium-manganese ferrite having suitable rectangular-loop properties. Some nickel-iron alloys have rectangular loops, as I have described in an article in this series. They are likely to find increasing application in the computer field in the form of ultra-thin films, of the order 10^{-4} cm. thick or less, when they have reversal times less than 1.0 microsecond.

The reasons for high remanence have been discussed earlier. The squareness of the demagnetization quadrants of rectangular hysteresis loops is governed by factors which are less well understood. In this part of the magnetization cycle reverse domains appear for the first time and studies of their nucleation have only recently been made.

Permanent Magnet Materials

Improvements in hard magnetic materials for permanent magnets during the last 60 years have been no less remarkable than those in soft materials. A magnet designed to produce a given field over a specified volume would have to be roughly 20 times heavier if made of an early magnet steel than if constructed using the materials now available. A good hard material will clearly have a large coercivity H_c, and a large remanence B_r. A very useful figure of merit is the maximum value of the product $B \times H$ attained in the demagnetization quadrant of the hysteresis loop. It can be shown that this maximum, BH_m, known as the energy product, is proportional to the square of the field which a well-designed magnet of a given volume can produce in the pole gap. Modern materials exhibit values for B_r, H_c and BH_m, in the ranges 5,000-13,000 gauss, 500-1,000 oersteds and 1.5-4.0 $\times$ 10^6 gauss-oersteds respectively, compared with 9,500 gauss, 50 oersteds and 0.2 $\times$ 10^6 gauss-oersteds for the high-carbon steels available 50 years ago. Many present-day applications in loudspeakers and microphones, in electrical instruments of many kinds, in

radar microwave generators, in motors, magnetos, and so on, have been made possible only by the development of the highly efficient alloys now available.

Up to 1920 the best hard materials were the cobalt-steels containing up to 35% cobalt. As the fraction of cobalt is increased the coercivity rises from about 50 oersteds to 250 oersteds, and the BH_m from 0.2 to 0.95×10^6 gauss-oersteds. Magnet steels contain about 1.0% carbon and small quantities of other metals. The carbon is distributed through the steel in the form of sub-microscopic islands of carbon compounds, and these impede the motion of domain walls and lead to high coercivities. These types of magnet steels are still fairly widely used.

About 1935, alloys based upon the aluminium-nickel-cobalt-iron system became available. These are known as diffusion-hardening alloys, and their permanent-magnet properties are developed by annealing at about 600°C after they have been quenched, i.e. rapidly cooled, from about 1,250°C. At 1,200°C these alloys are single-phase, the atoms of each metal being distributed uniformly through the material. When they are rapidly cooled in air or in an oil-bath this uniformity is frozen-in and remains. During the subsequent tempering at about 600°C, however, the atoms slowly diffuse and the alloy begins to separate out into two phases, minute submicroscopic islands of nearly pure iron forming throughout the lattice. This is an ideal situation, according to domain theory, if high coercivities and low permeabilities are required, since, not only is the lattice severely and very non-uniformly strained but the intensity of spontaneous magnetization varies from point to point because the composition of the material is non-uniform. Domain walls are therefore severely impeded. The hardest properties are obtained when the tempering has gone on just long enough for the islands to be in a very early stage of development. They are then so minute and are separated by such small distances that the magnetization processes are sometimes discussed in terms of single-domain particle concept described in the section dealing with the theory of magnetization processes. In fact, the process of a domain wall moving through a very inhomogeneous material of this type is very much the same thing as the progressive reversal of single-domain particles which are so close to one another that there is pronounced magnetic interaction between them. The two models, domain wall movement and single-domain rotation, approach the same problem from different directions, and it is satisfactory that both are capable of explaining the high order of coercivity found in diffusion-hardened materials.

Alloys of this kind are known commercially as the Alnicos and are made up of roughly ½ iron and ¼ each of aluminium, nickel and cobalt, there being some variation among the several alloys which come under this name. They have coercivities in the range 700-1,000 oersteds, remanences between 5,000 and 8,000 gauss, and energy products from 1.0 to 2.0×10^6 gauss-oersteds.

An important development came with the discovery in 1938 that diffusion-hardening alloys responded to the application of a field of some 1,000 oersteds during the quenching operation. The coercivity was not changed, but the remanence in the direction in which the field had been applied was increased considerably, as was the magnitude of BH_m. In the perpendicular direction these properties were reduced. Alloys thus treated are known as Alcomax, Ticonal, Alnico V and VI, and Hycomax, depending on the country of origin. They have roughly the composition 8% aluminium, 13% nickel, 25% cobalt, 3% copper and the rest iron. Their remanences and BH_m are 10,000-12,000 gauss and $3\text{-}5.5 \times 10^6$ gauss-oersteds respectively, and most good-quality magnets are nowadays made from these materials. The effect of the field applied during cooling is to orient the nuclei of the new phase, which are formed at this stage. The precipitate islands, which grow in the form of plates during tempering, are therefore aligned close to the field direction, making that a preferred direction of domain magnetization. This leads, as in the domain-oriented nickel-irons, to an increased remanence.

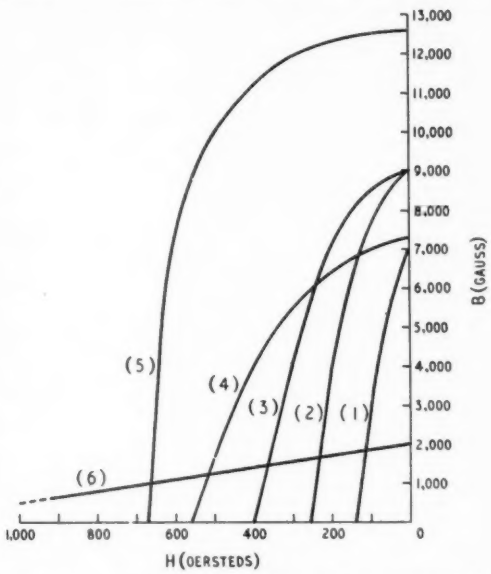


Fig. 23. Demagnetization quadrants of some permanent magnet materials. (1) 3% cobalt steel. (2) 35% cobalt steel. (3) Finely powdered cobalt-iron alloy (single-domains). (4) Alnico. (5) Alcomax III. (6) Permanent magnet ferrite (Hc 1,500 oersteds).

Fig. 23 illustrates the properties of the three kinds of permanent magnet materials discussed above. Alnico and Alcomax alloys are brittle and difficult to machine. They are normally cast in their final shape, and may be ground to size. Some precipitation-hardened alloys are machinable, such as Remalloy, Cunico and Cunife, but they are not greatly superior to cobalt-steels and are only rarely used in this country.

In recent years there have been two important new developments in hard materials. First, a ferrite suitable for use in permanent magnets has been discovered. This is a cobalt ferrite and is produced under such names as Vectolite and Ferroxdure. It can have H_c as high as 1,200 oersteds, but its remanence is low at about 2,000 gauss. Its lightness, high resistivity, and especially high coercivity, fit it for a number of special applications.

A permanent magnet barium ferrite is also available under the name Magnadur. The crystal grains in these ferrites are not much larger than the critical size for single-domain behaviour, and their properties have been interpreted in terms of their high anisotropy constant K and low B_s.

The second recent advance in permanent magnet materials is the production of powdered alloys in which the particles are sufficiently small to be genuine single-domains as discussed in the section on domain processes. Powder magnets are available which are made of iron or iron-cobalt alloys having particle sizes of about 2×10^{-6} cm. Spherical single-domain particles have maximum theoretical coercivities of $2K/I_s$. For iron this is about 600 oersteds. If the particles are elongated, however, the theoretical maximum coercivity is of the order $2\pi I_s$, that is about 10,000 oersteds for needle-shaped oriented particles of iron. Powdered iron pressed into a compact mass and available under the name Gecalloy, can have H_c greater than 500 oersteds, and iron-cobalt powders have H_c greater than 650 oersteds. The particle size of 2×10^{-6} cm diameter is about 100 times smaller than the powders used to reduce eddy current effects in radio-frequency coil cores. Powder magnets are comparable to the Alnico alloys in their properties. They are lighter, however, and contain no expensive materials, and their B_r and H_c can be tailored to specification by adjusting the density of packing. An indication of what may be achieved using fine powders is given by the magnets fabricated from powdered manganese-bismuth. This material has a remarkably high anisotropy constant, K_u and therefore has an H_c as large as 3,400 oersteds.

Fine powders of iron oxide have been widely used recently for magnetic recording tape. In order that the magnetic pattern on the tape be permanent a low ratio of B_r to H_c is required, since the self-demagnetizing effect is proportional to B_r. The ferrites are therefore especially suitable having very high H_c and comparatively small B_r. The particles may be produced in needle form.

Conclusions

My aim has been to illustrate how the extraordinary variety of behaviour to be found among ferromagnetic alloys and compounds can be interpreted by the simple ideas of domain theory. There remain, of course, many interesting effects which have yet to be satisfactorily explained, but the difficulties are often those of choosing between two or more possible domain interpretations. To the engineer the importance of domain theory lies in its ability to suggest in which ways a material might be improved and the limits beyond which no advance could be made.

REFERENCES

K. Hoselitz; " Ferromagnetic Properties of Metals and Alloys " (Oxford, 1952).

M. G. Say, Editor, " Magnetic Alloys and Ferrites " (Newnes, 1954).

R. M. Bozorth; " Ferromagnetism " (D. Van Nostrand, 1951).

C. Kittel; *Review of Modern Physics*, Vol. 21, p. 541, 1949.

C. Kittel and J. K. Galt; " Solid State Physics," Vol. 3, (Academic Press, New York), 1956.

L. F. Bates; " Modern Magnetism " (Cambridge, 1954).

Books Received

Fun with Radio, by Gilbert Davey. Radio correspondent of *Boys Own Paper* gives detailed practical constructional details for fifteen circuits, including crystal sets, a number of portable receivers, a superhet and single-ended amplifier with negative feedback. Pp. 64; Figs. 34. Price 10s 6d. Edmund Ward (Publishers), Ltd., 194-200, Bishopsgate, London, E.C.2.

Fernsehröhren, Eigenshaften and Anwendung, by H. Hönger and C. Reuber, covers general use of valves (including c.r.t.'s) in television receivers; followed by characteristics of particular valve types with practical examples of their use. Pp. 160; Figs. 270. Price 15DM. Regelien's Verlag, 16 Hubertusbader Strasse, Berlin-Grunewald.

Repairing Hi-Fi Systems, by David Fidelman, gives general principles of correct operation and common types of fault for amplifiers, a.m. and f.m. tuners, record players (with pickups), loudspeakers and tape recorders; and also discusses typical test equipment. Pp. 203; Figs. 98. Price 3 dollars 90 cents. John F. Rider, Inc., 116 W. 14 Street, New York 11. Obtainable in this country from Modern Book Co., 19-23, Praed Street, London, W.2. Price 23s.

Elements of Tape Recorder Circuits, by Herman Burstein and Henry C. Pollak. Besides equalization, bias and erase, and level indicating circuits, also discusses general aspects of tape recording, including head and tape characteristics and methods of reducing hum and noise. Pp. 223; Figs. 144. Price 2 dollars 90 cents with soft cover, or 5 dollars hard cover edition. Obtainable in this country from Modern Book Co., 19-23, Praed Street, London, W.2. Price 23s (soft cover) or 40s (hard cover).

Industrial Television, by H. A. McGhee. General section discusses pick-up tubes and circuit design of associated equipment. Applications described include underwater and airborne television, use with microscopes and telescopes, and in atomic research. Pp. 120; Figs. 104. Price 15s. George Newnes, Ltd., Southampton Street, Strand, London, W.C.2.

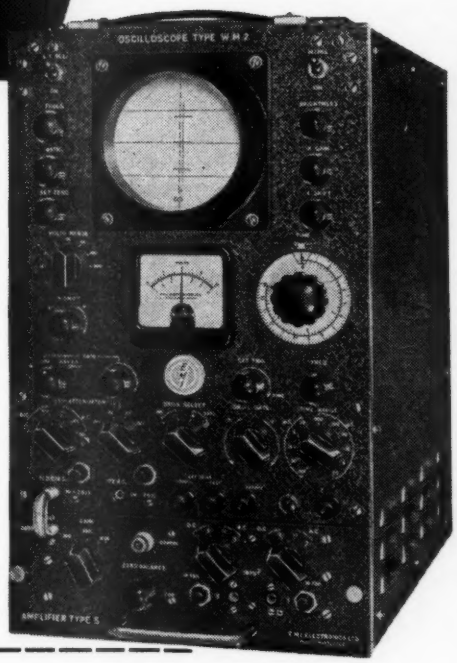
Problems in Radio Engineering, by E. T. A. Rapson. Seventh edition has more numerical problems from examination papers (with solutions); and additional material on negative feedback, the valve as a reactor, and frequency discriminators, following the previous pattern of introductory notes and formulæ. Pp. 177. Price 15s. Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, London, W.C.2.

New Equipment and Methods for the Evaluation of the Performance of Lenses for Television, by W. N. Sproson, M.A., B.B.C. Engineering Monograph No. 15, describes photoelectric optical bench used to measure loss of contrast for various numbers of bars per mm on a pattern, and discusses a suitable single index for evaluating lens performance for television. Pp. 16; Figs. 19. Price 5s. B.B.C. Publications, 35, Marylebone High Street, London, W.1.

PRECISION OSCILLOSCOPES

from the E.M.I. range

✻ *with exclusive direct reading measurement system*



An outstanding and versatile wideband oscilloscope

Well suited to a variety of applications — such as production testing, single shot photography and design and maintenance work on radar, television and computers.

- ✻ Direct time and voltage measurement with 2% accuracy
- ✻ Differential inputs
- ✻ Built-in signal delay
- ✻ Bandwidth DC to 12 Mc/s
- ✻ Y sensitivity at full bandwidth 100 mV/cm
- ✻ Maximum Y sensitivity 3 mV/cm

TYPE WM2 Price £285 IMMEDIATE DELIVERY

(Plug-in preamplifier £75)

A remarkably compact oscilloscope

With direct reading measurement system. For testing and development work on radio, television and other electronic equipment. Dimensions 9½″ x 6½″ x 10½″. Weight 15½ lb.

- ✻ Accuracy : direct 2% via attenuator 5%
- ✻ Maximum frequency response DC — 10 Mc/s (—3 db): Sensitivity 4 V/cm
- ✻ Maximum Y Sensitivity 185 mV/cm at reduced bandwidth

TYPE WM4 Price £65

Visit

STAND No. 506, I.E.A. EXHIBITION

16th-25th April

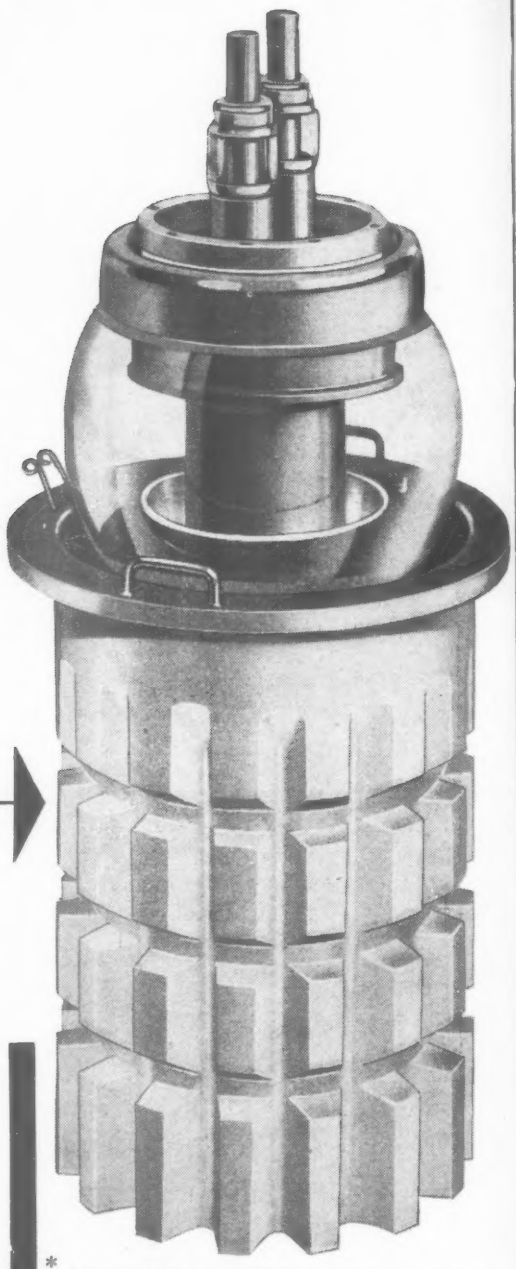
For further details of these instruments, telephone or write to:

E.M.I. ELECTRONICS LTD.

INSTRUMENT DIVISION · HAYES · MIDDLESEX

Tel : SOUthall 2468 Exts. 1071 and 655

EE 145



Vapotron
Vapour-cooled
Power Valves

For the first time in Britain, Power Valves using the Vapotron technique for cooling are now available. Ediswan have three types ready* and others under development.

For radio frequency heating and wherever large power has to be dissipated the Vapotron has distinct advantages over conventional water and air cooling methods. Full details of these advantages will gladly be sent on application.

EDISWAN manufacture a wide range of industrial and transmitting valves.

* **AVAILABLE TYPES...** ESV 1500
ESV 892
ESV 1002

EDISWAN

Send for further details on Vapotrons and ancillary equipment.

SIEMENS EDISON SWAN LTD (Industrial Valve Division)

155 CHARING CROSS ROAD · LONDON · W.C.2 *'PHONE GERRARD 8660 · 'GRAMS AND CABLES SIESWAN CENT LONDON · (An A·E·I Company)*

XUM

Pulse Counter F.M. Receiver

By M. G. SCROGGIE, B.Sc., M.I.E.E.

SINCE details of the "Unconventional F. M. Receiver" were published in the June 1956 issue the prototype has been in continuous domestic use for a year; also a number of readers have written to report on their experiences with receivers made to the same design or modifications of it.

The original design provided switch tuning to the three B.B.C. v.h.f. programmes, and yielded an a.f. output of about 0.8 V max. It comprised one r.f. stage, a diode frequency changer with triode oscillator, two resistance-coupled i.f. stages working at 150 kc/s or thereabouts, a pentode limiter and a two-diode pulse-counter discriminator with output filter and de-emphasizer. The second triode in the same bulb as the oscillator was used to stabilize the oscillator frequency by varying the magnetization of the miniature ferrite core on which the oscillator coil was wound. This type of receiver has the considerable advantages—especially for home constructors—of needing no i.f. or discriminator alignment or special instruments, and of being capable of lower distortion than the ratio discriminator or even the Foster-Seeley.

SUPPLEMENTARY NOTES, INCLUDING PARTICULARS OF CONVERSION TO CRYSTAL CONTROL

In the simple form described, its sensitivity is relatively low. This renders it unsuitable for fringe areas, and necessitates an outdoor aerial in some of those areas where more conventional f.m. receivers would manage on an indoor aerial, or a full-sized indoor aerial where they would manage with something inside the cabinet. So it is interesting that the several readers who reported experience with more sensitive modified versions of their own were all very pleased with the results. Mr. W. O'D. Whish, of Truro, using a preliminary conventional frequency conversion to 10.7 Mc/s, described extremely satisfactory performance at 85 miles from the local station over hilly country. He could not understand why there was not more enthusiasm about what seemed to him the ideal receiving system. An interesting point about this and other extensively modified designs was the latitude as regards types of valves, apparently no difficulty being encountered in substituting EF50, etc., for those specified.

Mr. D. Birt, of Oxted, carried out careful direct comparisons between discriminators of the pulse-counter and ratio types, using a 10.7 Mc/s-to-125 kc/s frequency changer between the input to the ratio discriminator and the limiter preceding the pulse counter, and equalizing the a.f. outputs to enable the same a.f. equipment to be used for either by a switch-over. The consensus of opinion among listeners to it was clearly in favour of the pulse counter, the improvement in quality being especially noticeable with speech and vocal music and less so with heavy orchestral music. The pulse counter showed up a loss of bass in the ratio discriminator until its usual 8μF capacitance had been increased to 25μF.

A letter from Mr. L. D. Stuart, published in the August 1956 issue, while generally favourable, seemed doubtful about the a.f.c. system—the experimental saturable-ferrite arrangement, in which the anode current of a triode controlled by the z.f. component of the discriminator output is passed through the coil of a P.O. relay modified to take the oscillator tuning coil core between its pole pieces. It is true that, as stated in the original description, the magnetic circuit of this system is rather susceptible to stray magnetic fields and ought to be enclosed in a Mumetal screen if a really low hum level is to be achieved. Subject to this, however, the system was very effective, and only once during its year of service—in the exceptional heat wave of last June—did it need any readjustment. (For that matter, no other part of the receiver needed any attention at all in a year of daily use.) With that exception, the a.f.c. invariably pulled the oscillator frequency within the necessary tolerance (about $\pm 0.04\%$), notwithstanding that no frequency-stability precautions whatsoever were taken in the simple switch tuning circuit.

The only real shortcoming of the receiver has been the perceptible amount of hum, due to the unscreened a.f.c. coil and (to some extent) the 2-ft. high-impedance lead from output to a.f. amplifier. The first cause could be overcome by a screen and the second by a cathode follower.

However, since several readers (no doubt with the "Crystal-Controlled F.M. Receiver" of Mr. D. N. Corfield before them in the following issue) inquired about crystal control as an alternative, this has been tried—unfortunately after a longer interval than had been hoped. Crystal control offers this type of receiver an undoubted combination of advantages:

(1) The channel frequencies and intermediate frequency are automatically set up without calibrated signal generator or guesswork.
(2) They are maintained positively under all conditions.
(3) They are maintained within closer limits, enabling the i.f. to be designed closer to the optimum value, and ensuring uniformity of the corresponding high standard of performance.
(4) The triode released from a.f.c. duties is available for an output cathode follower; both potential causes of hum are thus removed, and if necessary a longer output lead can be used.
(5) One pre-set adjustment (a.f.c.) is eliminated.
(6) There is more latitude in the design of the oscillator tuning circuit, which can also be more readily screened to prevent radiation.

Against these must be set the cost of one crystal

per channel, which is not negligible, especially if the owner is obliged to move from one part of the country to another where different f.m. frequencies are used.

The conversion proved even easier than expected. The first type of oscillator circuit tried, though slightly different from that of Mr. Corfield, being closely similar to the original one, worked perfectly. Fig. 1 shows the relevant parts of the circuit: (a) as originally, and (b) converted to crystal control.

The third-harmonic system is still used, to avoid the interference with viewers of the B.B.C. London television programmes that might occur if the oscillator frequency were chosen so that its second harmonic beat with the Wrotham signals. The crystal frequencies are therefore as follows:

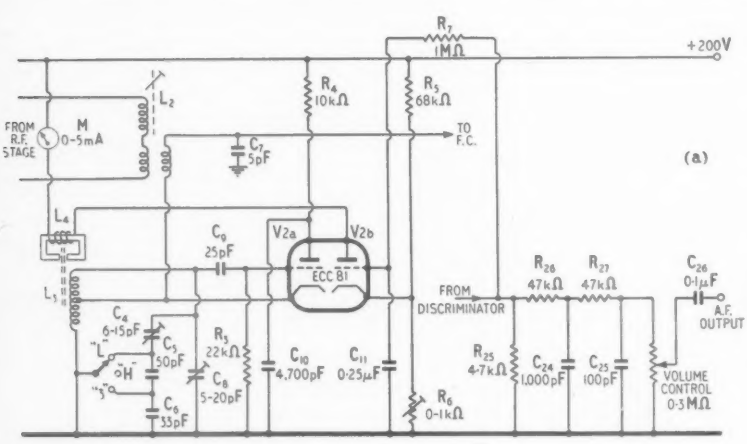
Programme	Wrotham frequency Mc/s		Oscillator 3rd harmonic Mc/s	Oscillator fundamental (crystal) frequency Mc/s
Light ...	89.1	120 kc/s	88.98	29.660
Third ...	91.3		91.18	30.393
Home ...	93.5		93.38	31.127

As a Midland reader pointed out, however, the reverse situation obtains in that region, for second-harmonic working puts the oscillator frequency well clear of the local Band I television channel (4), whereas the second harmonic of an oscillator for third-harmonic working would clash with it. It seems unlikely that a harmonic of the oscillator would in any case interfere appreciably with television reception, except perhaps in unusual circumstances, but one might as well be on the safe side. Mr. David Deacon who (in the August, 1956, issue) manifested alarm on behalf of the amateur 10-metre band, would no doubt support any advice tending to restrict the number of oscillators in or near that band. But in view of the complete absence of a single reported case of interference of any kind by this type of f.m. receiver, a more substantial reason for preferring second-harmonic working (outside Channel 1 areas) is that it gives about 50% greater sensitivity.

It will be noticed that the i.f., previously a nominal 150 kc/s, is now 120 kc/s. With the closer frequency control, this allows sufficient margin for deviation downwards, and is nearer the centre of the flat response band of the i.f. amplifier.

The method of altering the oscillator tuning capacitance by the programme selector switch in Fig. 1 (b) may look like a retrograde step, for it is the one whose disadvantages were given as a reason for introducing the improved method shown in (a). As it happens, the change was necessary in order to enable the crystals to be switched, without having to substitute a different type of switch. It proved not to be really retrograde, since adjustment of the capacitance for each channel is much less critical. Fig. 2 shows the arrangement of trimmers, extemporized from terminal heads; the performance varies little over most of their range of adjustment.

"Setting up" consists in adjusting the main capacitor C_8, with the switch at "H," to give maximum oscillator voltage at the cathode (not less than about 6V) if a



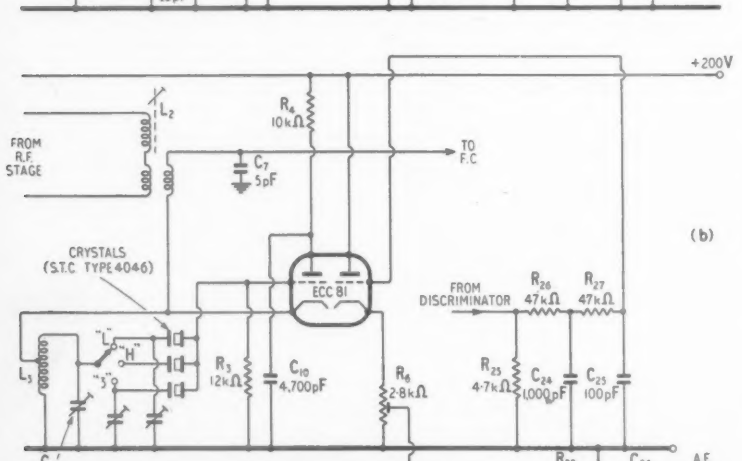


Fig. 1. Oscillator and output parts of circuit diagram: (a) as originally published, and (b) converted to crystal control. The former a.f.c. triode is used as an output cathode follower.

suitable valve voltmeter is available to measure it. If not, a 0-1 mA meter should be interposed between the grid leak R_3 and the earth line and set to maximum by C_8. It is not absolutely essential to use any meter at all, actually; all that needs to be done is to set C_8 to nearly the maximum value at which oscillation is obtained (on "H") and then at the other two positions of the switch adjust the trimmers so that similar conditions exist.

The oscillator coil, L_3, consists of nine turns of 22 s.w.g. wound on 1 cm. dia. polystyrene tube and tapped five turns from earth for the cathode. For second-harmonic working, presumably six or seven turns tapped at four would do, in conjunction with crystals of appropriate frequencies.

It should be noted that the specified frequencies of the crystals are the third harmonics of their fundamental frequencies of vibration, and that oscillation is possible at the fundamental and other odd harmonic frequencies. Only the desired frequency is obtainable within the range of the tuning circuit described, but the possibility of oscillation at an incorrect frequency should be borne in mind, especially in connection with modified designs.

R_6 is pre-set to give the desired range of volume control on R_{28} but if this is considered an unnecessary refinement R_6 can, of course, be adopted as the volume control and R_{28} omitted.

One may tend to assume that because all three transmissions are received from transmitters of equal power at the same site, on closely spaced frequencies, the signals obtained in a receiving aerial will not differ widely in strength. That is possibly a fair assumption if the aerial is erected well in the clear, free from reflections comparable in strength with the direct ray. It was unexpectedly wide of the mark in relation to the indoor aerial. Although only about 15 miles from Wrotham, the receiving site is screened by high ground, and indoors on the ground floor a full half-wave dipole is needed. It was quite easy to find a position giving 10 V or more to the limiter from one transmitter or even two, but moving the aerial a few inches to raise the third from an inadequate volt or so had the effect of bringing down one or both of the others catastrophically. Only one position in the room could be found that gave satisfactory signal strength from all three, and, of course, that was nowhere near parallel to the polarization! If the reflections were from a distance of several miles, such conditions would favour the kind of distortion discussed in the December, 1956, issue, but it appears that they are due mainly to metalwork in the house. This experience is mentioned here because the possibility of widely different signal strengths from transmitters in the same group of three does not seem to have been given much publicity in advice on the installation of v.h.f. aerials.

A feature of the pulse-counter type of f.m. receiver which should interest transistor enthusiasts is the fact that except for the preselector stage and the oscillator—perhaps not even the oscillator nowadays—all stages can be worked with transistors of readily obtainable types. At present the first stage at least might have to use one of the low-voltage pentodes designed for running in team with transistors off a car battery or its equivalent.

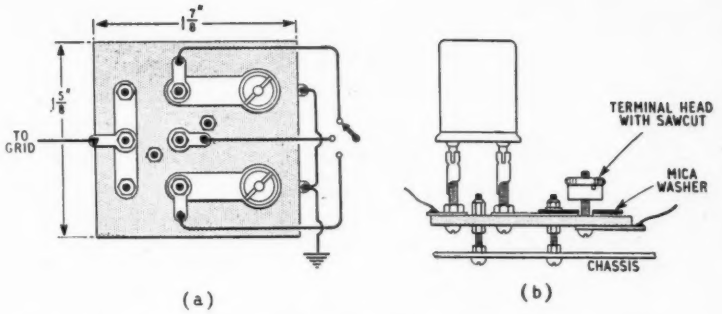


Fig. 2. Plan (a) and side view (b) of crystal holder and trimmer panel assembled from odd parts.

AUDIO FAIR

ALL but four of the 65 exhibitors (see below) at the London Audio Fair, which opens at the Waldorf Hotel, Aldwych, London, W.C.2, on April 18th, will be making use of private demonstration rooms in addition to having stands in the main exhibition.

The fair will be open to the trade only until 4.0 on the first day, but on the three following days (Saturday, Sunday and Monday) it will be open to ticket holders from 11.0 to 9.0. Tickets, dated for specific days, are obtainable free from exhibitors, audio dealers or by post from this office. Applications stating day of proposed visit (and, if possible, an alternative) must be accompanied by a stamped addressed envelope (6in by 3½in).

Although originally announced for five days, the Fair will close on Monday, April 21st.

A.K.G.
Acoustical Mftg. Co.
Altobass
Armstrong
Associated Electronic Engrs.
B.B.C.
B.S.R.A.
Beam-Echo
Brenell Engineering
Burne-Jones
Champion Electric
Chapman (Reproducers)
Collaro
Cosmocord
Dulci
Dynatron
E.A.P. (Tape Recorders)
E.M.I. Sales & Service
Electronic Reproducers
G.E.C.
Garrard
Goldring
Goodmans
Goodsell
Gramophone Record Review
Grampian
Grundig
Harting, Wilhelm
Hi-Fi News
Jason Motor & Electronic
Kolster-Brandes
Leak, H. J.
Lowther
Lustraphone
Minnesota Mining & Mftg.
M.S.S. Recording
Mullard
Multimusic
Pamphonic
Philco
Pilot
Pye Group Records
Pye
RCA Great Britain
R.G.D.
Rogers Developments
Rola Celestion
Simon Sound Service
Sonomag
Sound Sales
Specto
Sugden, A. R.
Tannoy
Tape Recording Magazine
The Gramophone
Trix Electrical
Truvox
Vitavox
Vortexion
Westrex
Wharfedale
Whiteley
Wireless World and *Electronic & Radio Engineer*
W. & N. Electronics
Wright & Weaire

Stabilized E.H.T. Unit

Design of a Compact Equipment for Anode Supplies

By D. J. COLLINS, B.Sc.(Eng.), A.M.I.E.E., and J. EDWARD SMITH,* B.Sc.*

IN analogue computing work, multipliers and function generators of the electron beam type are often used. The authors, when considering the design of a multiplier, were faced with the problem of maintaining tight control of the sensitivity of the cathode-ray tube. It became necessary to provide an e.h.t. unit with the following performance:

(a) The unit was to provide an e.h.t. voltage variable from 1350V to 1500V and of negative polarity.

(b) It was to provide a current of 450μA.

(c) The ripple content of the supply was not to exceed 150 millivolts peak-to-peak.

(d) Load changes of $\pm 2\%$ were to produce less than $\pm 0.1\%$ variations in output voltage.

(e) Changes in output voltage due to supply variations of $\pm 10\%$ were not to exceed $\pm 0.5\%$ of the nominal output voltage.

In addition, since this unit was to form only part of a computing unit assembly, it had to be compact and light and capable of operation from conventional computer supply lines. In view of this, the possibility of generating the e.h.t. from 50-c/s mains was ruled out, and the best approach appeared to be in using a high frequency e.h.t. oscillator which was stabilised with some form of control loop.

Basically, the e.h.t. was derived from the secondary of a transformer via a hard valve rectifier and filter circuit. The primary of the transformer formed the anode coil of a Class-C oscillator operating at 20 kc/s. The output level of this oscillator was controlled by varying the screen volts of the oscillator valve. The stabilizing control loop was provided by controlling this screen voltage indirectly from the e.h.t. output voltage. In general design of stabilized e.h.t. supply units where several e.h.t. voltages can be required, it is customary to obtain the feedback voltage from an independent winding of the e.h.t. transformer. The effect of the loop is then to stabilize the flux in the transformer. In this case, however, it was convenient to use the bleeder chain of the cathode-ray tube as one arm of the feedback network. This system has the same loop gain penalty as the independent winding, but provides a component saving of rectifiers and smoothing circuitry. The bleeder chain is external to the unit, and it is the poor stability of this chain, together with tube current variations, which produces the load current changes. The circuit diagram of the unit is shown in Fig. 1.

The detailed design was tackled in the following sequence:—

The Output Section.—The basic filter system was designed for the specified figure, since it was apparent from the circuit configuration that the control loop would exert very little effect on any 20-kc/s components on the e.h.t. supply. A hard valve rectifier was used in preference to a pencil type, because of its smaller physical size and lower stray capacitance. An initial assumption was made that the oscillator frequency was 20 kc/s, and a filter reservoir capacitance of 0.005μF was chosen. This value of capacitance did not present a size problem, and was considered adequate for the basic 20-kc/s components.

The subsequent filtering was to provide an attenuation of some 6,000:1, and it was felt that a single filter would assist in loop stability by limiting the phase shift in the filter to that of one time constant. The largest convenient filter capacitor had a value of 0.1μF, necessitating a filter resistor of 470kΩ.

* Solartron Research & Development.

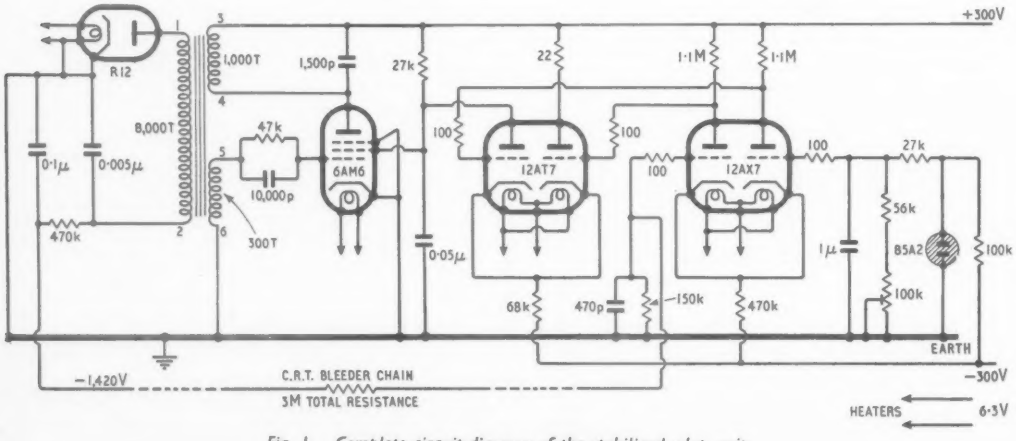


Fig. 1. Complete circuit diagram of the stabilized e.h.t. unit.

The nominal output voltage of 1,420V fixed the reservoir voltage at 1,630V d.c., which required a voltage of approximately 1,200V r.m.s. at the secondary of the e.h.t. transformer.

The secondary loading was of the order of one watt, and the obvious core choice was a ferrite material, although a suitable core form was difficult to find. Eventually, a pair of Mullard FX1315 cores was chosen. The cores have a round centre limb and adequate volume.[1]

It was considered that a Class-C oscillator used in this condition would give a swing of about 150V r.m.s. into the primary of the e.h.t. transformer. Using a maximum flux density of 1,000 gauss, the primary turns were calculated from the expression

$$N = \frac{0.225 \times 10^8 E}{f B_{max} A}$$

where A = cross-sectional area of the core

B_{max} = 1000 gauss

E = r.m.s. voltage across the coil.

This expression fixed the primary at 1,000 turns, corresponding to 6.7 turns per volt.

In oscillators of this type, an optimum anode-to-grid winding ratio has been found to be approximately 3:1 and, in view of this, the grid winding was set at 300 turns.

The secondary winding, consisting of 8,000 turns, was split into three sections (see Fig. 2), each section being pile wound into adjacent "windows" of a four-window Perspex former. This former fitted over the centre limb of the core, and the fourth window contained the primary winding. The sectioning of the e.h.t. winding reduced the possibility of voltage breakdown in the winding and also reduced self-capacitance. To complete the oscillator coil, the grid winding was wound over the centre section of the secondary. The core was gapped, and the two halves were mechanically clamped by synthetic resin-bonded paper cheeks which carried the winding terminations.

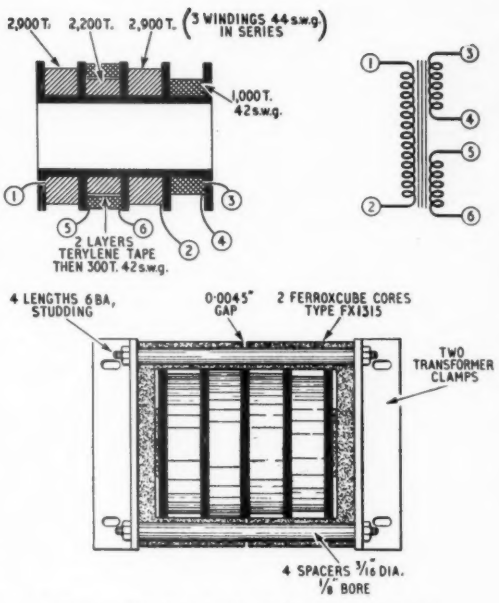


Fig. 2. Winding details of the e.h.t. transformer.

The Oscillator.—This used an EF91 pentode and was of conventional form. In circuits of this type, it has been found that there are two basic modes of oscillation. One is based on the main primary parameters and is usually of low frequency, while the other, attributed to a leakage reactance effect, is a mode of higher frequency. Invariably the higher frequency mode gives a better efficiency, and it is possible to select this higher mode by reversing the primary winding. The frequency of oscillation is adjusted by tuning the primary with extra capacitance. The angular period for which the valve conducts is controlled by the grid time constant and was adjusted in this case to be of the order of 80°. In this condition the peak pulse current was about 50 milliamps. The e.h.t. level was controlled by varying the screen grid voltage of the EF91, and when the e.h.t. was adjusted to its nominal value the screen grid voltage was about 150V.

While the e.h.t. oscillator was running on open loop, i.e., with no control voltage applied to the screen, it was found that heater voltage variations had little effect on the e.h.t. output. This suggested that the valve was working well within its capacity. On open loop, 10% variations in the h.t. line potential caused 10% changes in e.h.t., and 10% load variations had a similar effect. This indicated the need for a stabilizing loop.

The D.C. Amplifier.—The feedback information was applied to one grid of a long-tailed pair, the other grid having a reference voltage applied to it. There were several advantages of using a long-tailed pair as an input stage. The circuit gave a first-order reduction in contact potential drift, and

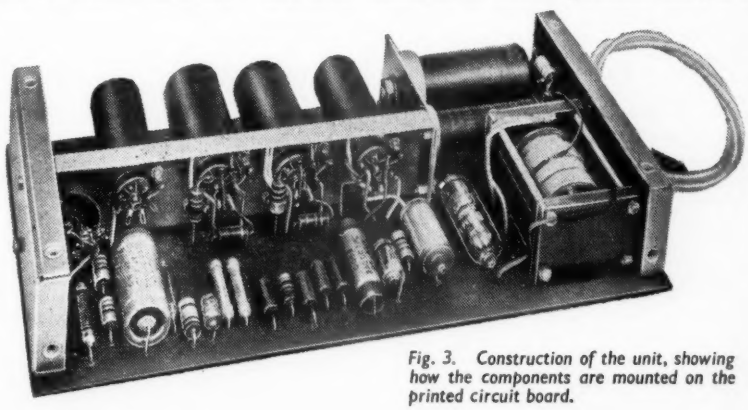


Fig. 3. Construction of the unit, showing how the components are mounted on the printed circuit board.

[1] See Mullard Ferroxcube Handbook.

presented a high impedance to the reference voltage source. The grids of this stage were quiescent at −68V, and variations of the output were obtained by variation of the reference voltage. The anodes of the long-tailed pair were directly connected to a cathode-coupled pair. The first half of the cathode-coupled pair acted as a cathode follower, and the anode of the other half section was d.c.-coupled to the screen of the oscillator valve.

The d.c. forward gain from the input grid to the e.h.t. output was of the order of 52dB. In the closed-loop condition, the feedback network had a loss of 27dB, reducing the loop gain to 25dB. This was adequate, however, to meet the specification. An important point to note was that the long-term stability of the output was not to a first order dependent on the supply stability, since there is a built-in reference source.

Construction.—The unit has been developed into computer "module" form, having overall dimensions 9½in deep, 1⅝in wide, and 5⅛in high (see Fig. 3). The majority of the wiring is carried on a printed board which also serves as a mounting chassis. The power supplies are fed in via a printed board connector, and the e.h.t. output is a flying lead. The unit has an overall screening cover (not shown in Fig. 3).

Finally, it must be pointed out that the design procedure of such a unit is by no means clear cut. Nevertheless, this design meets the specification required, and does so with relatively low power consumption. The power supplies required are: +300V, 16mA; −300V, 8mA; and 6.3V a.c., 1 amp.

R.E.C.M.F. EXHIBITION

Record Number of Exhibitors

THIS year's components show, the fifteenth organized by the Radio and Electronic Component Manufacturers' Federation, will have the record number of 168 exhibitors (listed below). It will again be held at Grosvenor House and Park Lane House, Park Lane, London, W.1, and will be open from 10.0 to 6.0 daily from April 14th to 17th.

Admission is by invitation ticket obtainable from the R.E.C.M.F., 21, Tothill Street, London, S.W.1, by engineers and technicians in the "user" industries, research, Government departments and the Services.

A.B. Metal Products
A.K. Fans
Aero Research
Air Control Installations
Allan, Richard, Radio
Anderton Springs
Anglo-American Vulcanized Fibre
Antiference
Ardente Acoustic Laboratories
Associated Electronic Engrs.

Bakelite
Belling & Lee
Bird, Sydney S., & Sons
Bray, Geo., & Co.
Brayhead (Ascot)
Brayhead Products
Brimar
British Communications & Electronics
British Electric Resistance
B.I. Callender's Cables
British Physical Laboratories
Bulgin

Carr Fastener
Cathodeon Crystals
Clarke and Co. (Manchester)
Collaro
Colvern
Connollys (Blackley)
Cosmocord
Creators

D.S.I.R.
Daly (Condensers)
Darwins
Diamond H Switches
Dubilier
Duratube and Wire

E.M.I. Sales & Service
Eddystone
Egen Electric
Ekco Plastics
Electro Acoustic Industries
Electro Methods
Electronic Components
Electronic Engineering
Electrothermal Engineering
Enalon Plastics
English Electric
Enthoven Solders
Erie Resistor
Ever Ready

Ferranti
Fine Wires
Formica
Fortiphone

Garrard
Goldring
Goodmans
Gresham Transformers
Guest, Keen & Nettlefold

Haddon Transformers
Hallam, Sleigh & Cheston
Harwin Engineers
Hassett and Harper
Hellermann
Henley's
Henry & Thomas
Hinchley Engineering Co.
Hunt (Capacitors)

Imhof
Instrument Review
Insulating Components and Materials

Jackson Bros.
J. Beam Aerials

K.L.G. Sparking Plugs

Langley London
Linton and Hirst
Lion Electronic Developments
London Electrical Mfg. Co.
London Electric Wire Co.
Long and Hambly
Lustraphone

M-O Valve Co.
Magnetic and Electrical Alloys
Magnetic Devices
Mallory Batteries
Mansol (Great Britain)
Marrison and Catherall
McMurdo Instrument Co.
Measuring Instruments
Mica and Micanite Supplies
Micanite and Insulators Co.
Minnesota Mining & Mfg.
Morganite Resistors
Mullard
Mullard Overseas
Multicore Solders
Murex
Mycalex and T.I.M.

N.S.F.
Neill, James, and Co.
Newmarket Transistor Co.

Oliver Pell Control

Painton
Parmeko
Partridge Transformers
Permanoid
Plannair
Plessey Co.
Plessey International
Power Controls

Radio Instruments
Reliance Mfg.
Reproducers & Amplifiers
Reslosound
Rola Celestion
Ross Courtney & Co.

S.T.C.
Salford Electrical
Salter, Geo., and Co.
Scott, Geo. L., and Co.
Shell Chemical Co.
Siemens Edison Swan
Siemens Ediswan (Valves)
Simmonds Aerocessories
Simon Equipment
Sims, F. D.
Spear Engineering Co.
Stability Capacitors
Standard Insulator Co.
Static Condenser Co.
Steatite and Porcelain Products
Stocko (Metal Works)
Suflex
Supply, Ministry of
Swift Levick and Sons
Symons, H. D., and Co.

T.C.C.
Taylor Electrical
Technical Ceramics
Technograph Electronic Products
Telcon Magnetic Cores
Telegraph Construction & Maintenance
Telephone Manufacturing
Texas Instruments
Thermo-Plastics
Thorn Electrical Industries
Truvox
Tucker, Geo., Eyelet Co.
Tufnol

Vacite Wire Co.
Victoria Instruments
Vitavox

Walter Instruments
Wandleside Cable Works
Waveforms
Wego Condenser Co.
Welwyn Electrical Labs.
Westinghouse
Weymouth Radio
Whiteley Electrical
Wiggin, Henry, and Co.
Wimbledon Engineering Co.
Wingrove and Rogers
Wireless Telephone Co.
Wireless World and *Electronic & Radio Engineer*
Woden Transformer Co.
Wolsey Electronics

Zenith Electric Co.

FREE — AN IMPORTANT BOOK

about YOUR CAREER • HOBBY...

...SPARE TIME WORK, etc....

...IN ANY OF THESE SUBJECTS:—

Accountancy
Advertising
Aeronautical Eng.
A.R.B. Licences
Art (Fashion Illustrating, Humorous)
Automobile Eng.
Banking
Book-keeping
Building
Business Management
Carpentry
Chemistry
City & Guilds Exams.
Civil Service
Commercial Subjects
Commercial Art
Computers
Customs Officer
Draughtsmanship
Economics
Electrical Eng.
Electrical Installations
Electronics
Electronic Draughtsmanship
Eng. Drawing
Export
General Certificate of Education
Heating & Ventilating Eng.
'Hi-Fi' Equipment
High Speed Oil Engines
Industrial Admin.
Jig & Tool Design
Journalism
Languages
Management
Maintenance Eng.
Mathematics
M.C.A. Licences
Mechanical Eng.
Metallurgy
Motor Eng.
Painting & Decorating
Photography
P.M.G. Certs.
Police
Production Eng.
Production Planning
Radar
Radio
Radio Amateurs (C. & G. Licence)
Radio & Television Servicing
Refrigeration
Sales Management
Sanitary Eng.
Salesmanship
Secretaryship
Servo Mechanisms
Shorthand & Typing
Short Story Writing
Short Wave Radio
Sound Recording
Telecommunications
Television
Time & Motion Study
Transistors
Tracing
Welding
Workshop Practice
Works Management
and many others

NEW PRACTICAL DO-IT-YOURSELF

YOU CAN MAKE & SAVE MONEY IN:—

RADIO & T/V BUILDING & SERVICING

ELECTRICAL APPLIANCE REPAIR

CHEMISTRY • PHOTOGRAPHY

HI-FI EQUIPMENT, ETC.

All the above special courses include practical equipment as part of the training.

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H.&V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B. Servicing Certificates, R.S.A. Certificates, etc.

- Personal and Individual Tuition given by named tutors
- All equipment yours to keep
- Courses for Beginner or Advanced student

EMI INSTITUTES

E.M.I. Institutes is associated with:
"HIS MASTER'S VOICE", Columbia, etc.

POST TODAY

To:— E.M.I. INSTITUTES, Dept. 127K, LONDON, W.4

Please send, without any obligation, your free Book to:—

NAME ..... AGE ..... (if under 21)

ADDRESS .....

.....

Subject(s) of interest ..... With* / Without* equipment

(We do not employ travellers or representatives)

APRIL/58 *Delete as required. IC.118

The only Home Study College run by a World-wide industrial organisation

Mr. Monarch offers you

the turning point in perfection

"Making music for millions"

The brilliantly successful

Monarch UA8

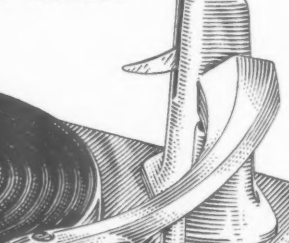
World's Finest 4-speed Autochanger

Keeping right on the track to the point of perfection, automatically you think that Mr. Monarch and his backroom boys have something to be proud of. Painstaking research allied with the finest engineering methods from the largest autochanger factory in Europe have combined to give the world's finest 4-speed autochanger. The Monarch always finds its way into the right set because it's the only autochanger with *all* the star features.

- ★ Plays all records at all speeds.
- ★ Intermixes ten 7in., 10in. and 12in. records of the same speed.
- ★ Pickup fitted with world proved Ful-Fi high fidelity crystal cartridge.
- ★ Modern duo-tone finishes harmonise with any room decor.

BSR

ful-fi



The brilliance of Monarch reproduction lies in the superb Ful-Fi high fidelity turnover crystal cartridge. It combines wide tonal range with a flat response bringing out the best from all amplifiers.

FUL-FI CARTRIDGES CAN BE FITTED INTO ALL STANDARD PICKUP ARMS.

N.B.—Always buy B.S.R. Ful-Fi replacement needles and maintain the original standard of your Ful-Fi cartridge.

BIRMINGHAM SOUND REPRODUCERS LIMITED

LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

Forward Scatter

I WAS very interested in the ionospheric forward scatter propagation section of your report in the March issue on the Symposium held at the Institution of Electrical Engineers in January.

Ever since the appearance, in *Physical Review* in 1952, of the paper "A New Kind of Radio Propagation at Very High Frequencies Observable Over Long Distances" by D. K. Bailey *et al*, the feeling, in this country, has been one of pessimism towards the possibilities of this form of propagation. Much emphasis has been placed here on the difficulties facing ionospheric forward scatter, in particular its interference potential and its own susceptibility to interference and multipath from back scatter.

I was therefore very glad to see in your summary of the I.E.E. Symposium the statement that "It is only fair to add that, despite the difficulties, the U.S. Authorities are using several such links upon an operational basis."

I had the privilege, on February 20th of being at the meeting of the Armed Forces Communications and Electronics Association when Major General Alvin L. Pachynski, Director of Communications-Electronics, U.S.A.F. and Mr. Richard Kirby of the National Bureau of Standards, Colorado, read papers on the operational reliability and the technical characteristics of the various scatter circuits in use by the U.S.A.F. Their optimism and dynamic approach was in complete contrast to the conservatism seen here. These were people who had, for several years, operated thousands of miles of traffic-carrying scatter systems and who overcame the difficulties as they arose. The great bogy raised in the U.K., namely, the susceptibility of ionospheric forward scatter systems to back scatter, has been resolutely tackled by the U.S., and Richard Kirby expressed the view that back scatter would shortly cease to be a significant factor. In particular, reference was made to the use of ARQ* and to the frequency translator system† developed by the Page Corporation of America. The latter, on the routes on which it has been tried, has reduced "outages" from back scatter to near negligible proportions. Both speakers pointed to the very low reliability of conventional H/F radio circuits across and within the North Atlantic and showed the far greater reliability of their scatter systems in the area. (Mention was made of the excellent performance of the ionospheric forward scatter links during the very severe ionospheric storm of February 11th when conventional North Atlantic H/F circuits were out for many hours.)

Surely it is time we in the U.K. accepted the unique properties of ionospheric forward scatter and at least appreciated its value to areas where conventional H/F can be unreliable. Further, we should bear in mind that, so far, the U.K. has tested only two experimental links and has never been called on to use its ingenuity, mechanically or electrically, to overcome the difficulties of actual traffic transmission. Whereas we have only aired these difficulties here the U.S. have gone a very long way towards solving them.

Weybridge. R. J. HITCHCOCK.

Aerial Measurements

THE article by Mr. F. R. W. Strafford in the February 1958 issue on conditions to achieve accurate results in measuring TV aerial performance has been read with considerable interest. The method described has been used for a number of years on a variety of frequencies and no difficulty has been encountered in obtaining consistant agreement between measured and calculated polar diagrams of dipoles used for checking purposes. This agreement has generally been within ±1 dB, but on the few occasions when this tolerance has been exceeded, the cause has been located and remedied. Moisture absorption in the wooden supports near the aerial under test has been the chief offender, and has been found to cause disturbances of 2 to 3 dB.

With regard to horizontal polarization, while it is agreed that there is not a critical Brewster angle such as occurs with vertical polarization, experience here is that the interference pattern due to ground reflection with horizontal polarization dies out at about the same distance as with vertical polarization. It has been assumed that this is due to the increasing losses incurred by scattering and absorption at small angles of incidence. These experiments were carried out on an open expanse of grass, and resulted in a choice of height and working distance of 8ft and 120ft respectively, agreeing exactly with Mr. Strafford's ratio of 15. It is, however, recommended that this ratio should be adhered to also for horizontal polarization, as experience here is that the distance could not be "safely halved" as suggested in the article. C. O. TITLEY,

Sir W. G. Armstrong Whitworth Aircraft Ltd.
Baginton, nr. Coventry.

Valve Failures

IN my work as a service engineer I have had to replace, during the last few years, many hundreds of valves which have failed prematurely. Probably half of these failed within the guarantee period, but far too many of these have failed after the end of the 90 days allowed by most manufacturers as the free replacement period.

Valve failures, with the expense of a new valve and purchase tax, plus the charge for a service visit, are a source of great dismay to owners of new television sets. Some owners, if they are really unlucky, have to buy two or three valves in less than a year.

There seems to be two main causes of these premature failures. In some cases, set manufacturers are to blame for overrunning or overdriving a valve in a new circuit. This happens very often in the first few months after the introduction of a new design, and service engineers could tell of lots of cases where a particular model has always burnt up its first overrun valve within the first six months. The same valve, in another circuit, has had no serious failures, and proves that the valve is quite a good type if properly used. A new triode/output pentode, with 300-mA heater, has had quite a chequered life up to now in one very popular set, and in another model the failure has always been a new type high voltage rectifier.

But a more common occurrence is valve failure due to new types having been released before they have been properly tested, or at least before the production department has really got tolerances worked out. We can all think of valve types, up to a score of them, which when first introduced were a constant source of trouble. Now, after the production has got down to it, they are as trouble-free as valves can be, thus proving that the early ones were at fault either electrically or mechanically. To go back many years, there was a period a few years after the war when so many failures had occurred with a new type 300-mA multiple rectifier that sets had to be laid up, as the makers could not supply the demand for replacements. This same valve type is now a good old stager, never gives more than a very occasional demand for a spare.

* Automatic repetition of obliterated characters.
† The frequency is changed after the forward scatter signal has been received and before the back scatter arrives.—Ed.

There are lots more examples, right up to the present day. The triode/r.f.-pentode frequency changer introduced a couple of years ago was a very bad offender for over a year, but now it is dependable. But a six-volt booster diode introduced six years ago is still on the unreliable list. Its weakness has always been intermittent heater, I have changed about a hundred myself, nearly always at the customer's expense.

I wonder why set manufacturers, when they find they have sent out a model with an overrun stage, do not contact the users to offer to reimburse them when the inevitable expense crops up? And valve makers, could they not extend the guarantee for an indefinite period when it becomes apparent that one of a new range is proving unreliable? If these concessions were allowed, the servicing industry could free itself from the bad reputation it has often been awarded, for charges which should really be borne by the makers of the sets or valves.

London, N.8. J. SPENCER.

Solid (Deprived?) Sound

WITH reference to "Free Grid's" item "Ni-Fi Stereophony" appearing in the March issue of your magazine I would like to draw your attention to the fact that the word "stereo(n)," the Greek adjective (στερεότ), means "solid"; apropos, there is no doubt about the happy choice of the word stereophonic to convey the desired meaning in English, because a "solid" sound is "three-dimensional" sound, which after all is the generally accepted interpretation.

On the other hand the Greek word for "I rob," or "deprive of" is "stero" (στερῶ), a verb.

London, S.W.7. ANTONIOS SIMONIS.

Tape Speeds

"FREE GRID'S" proposal of a unit for tape speed would be helpful if the unit were by definition reciprocal. Otherwise we might in time be sorry we had not made the unit smaller, or be reduced to something like a deci-Stille (or deci-Poulsen?).

Let us rather take an example from television, where we speak of Band III and Channel 9 and nobody worries about odd fractions of a megacycle.

Therefore, let 30 in/sec be Speed One.

Then, Speed N would be $\left(\frac{2}{2^N} \times 30\right)$ inches per second.

Thus, $1\frac{7}{8}$ in/sec is Speed 5, $\frac{15}{16}$ in/sec is Speed 6 and so on.

London, S.W.3. RICHARD SWETTENHAM.
Argo Record Company, Ltd.

LET us have x stilles $= \frac{30 \text{ in/sec}}{\text{actual speed (in/sec)}}$ which will permit further 2:1 reductions in speed during tape development and yet allows the use of a whole number when the actual speed is expressed in this new unit.

On the matter of what to call this unit, I think that "Free Grid's" suggestion is excellent. Is not the tape speed slowing down and may eventually become "still"? (I here creep out of the back door, having suddenly realized that 1500 "stills" sounds like a gallop.)

Newnham, Glos. R. S. BOUGHTON.

Optical Noise Filter

WHEN the diaphragm of a camera lens is made smaller the cone of light from lens to film (corresponding to a point on the object) becomes slimmer and the angle at the apex is smaller. This allows greater latitude in image distance or, if this is fixed, object distance (depth of focus) for an acceptable standard of sharpness. The more a lens is "stopped down" the greater latitude is obtained until at an aperture of $f/100$ one has virtually a pin-hole camera and the lens might just as well be thrown away. At no point does the angle of view become narrower.

The human eye, with its automatic focusing, has no use for such a variable stop. Only when the lens is not functioning correctly does the need for spectacles arise. Without them the cone of light from each point is either too short or too long and the effect of viewing through a small hole is the same as in a photographic camera. The narrower angle of view in this case is only incidental and is due to the fact that the hole is at a considerable distance in front of the eye's own iris instead of being at the centre of the lens as it should be in a perfect camera. From this it is obvious that for a person of normal eyesight the pin-hole effect does not work.

May I finish by drawing attention to another interesting aspect? This is the pin-hole microscope. Tiny objects placed about 5 cm in front of an eye cannot be seen clearly, but the use of a pin-hole between object and eye produces a sharp image. The closeness of the object is the cause of the apparent magnification.

London, N.6. J. E. AMPHLETT.

I THINK the explanation of the increase in definition in objects viewed through a hole between the fingers lies in the diffraction of light around obstacles.

I, myself, am short-sighted. If a short-sighted person views a cross at a distance through the linear slit between two straight-edged objects, held close to the eyes, he will notice an increase in definition only in lines of the cross parallel to the slit. Any person doing this simple experiment will notice also dark lines running parallel to the slit, and which move with the slit, if the field of view is altered. These are interference fringes.

If a short-sighted person views distant objects past the edge of another object held about 2 inches from the eye, he will observe an increase in definition of the far objects appearing very close to the edge of the near object, and again only in lines parallel to the edge.

The hole between fingers allows light to diffract around the edges. It thus acts as a concave lens, and this is the type of lens used to correct short sight.

The slit between two straight, close objects acts as a cylindrical lens, and hence only corrects the sight in the plane of the slit.

Oxford. D. HERBISON EVANS.

"Do It Yourself" Interference

ALTHOUGH I feel that the four months which have elapsed since the end of my Studio "E" "One-valve Set" series have proved the point I made in my earlier letter, and no National Interference Crisis has arisen, I must ask again to be allowed to make one or two points in reply to Mr. Douglas Walters' letter in the March issue.

First, one does not casually go along to Lime Grove and produce the design before the cameras. It is endlessly probed for weeks beforehand by every possible B.B.C. department, including several branches of the Engineers. I personally discussed the receiver with the latter on four occasions, particularly with regard to the interference question. Incidentally I was rewarded by a most fascinating tour of one of their experimental labs. as a result.

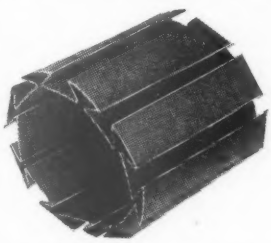
As Radio Correspondent for "B.O.P." for many years I have discovered (or evolved!) the special technique in writing about radio for boys. Designs must be simple and not require complicated lining-up. They must get results anywhere in the country and need not be too modern in outlook (there is usually some old junk in the attic). The chief thing is low initial cost and low running cost. Mr. Walters would calmly double the cost of the receiver and the battery consumption when, as I did, reducing the value of the reaction capacitor achieves the same result. Besides which the selectivity problem is not solved by adding an untuned r.f. stage (not to mention the thousands of letters I should get commencing "My Dad says it would be better to tune the first stage. . . ").

I am grateful to Mr. Peter Tansley for the support given in his letter in the February issue.

Kenton, Middlesex. GILBERT DAVEY.

Technical Notebook

Lower Valve Temperatures, reducing the chances of glass envelope failures, become possible with a new kind of metal insert for use between the valve and its screening can. It is a cylindrical device in which the metal is folded into something like the box pleats used in kilts and skirts (see illustration). This gives almost continuous contact between the valve envelope and the screening can and consequently a high degree of thermal conduction. Made by the Atlas E-E Corporation in America, the insert has the additional advantages that it takes up variations in valve



and screening-can diameters and provides cushioning for the valve against shock and vibration.

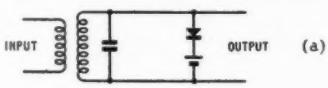
Higher Speed Digital Computers for "real time" operation, with digit pulse rates probably in the region of 10 Mc/s, are the subject of preliminary investigations now being made by the National Research Development Corporation. It is possible that transistors may prove more satisfactory components than valves in this p.r.f. region. Although the transistor cannot be made to operate so easily at high frequencies because of the slowness of the current carriers, it is inherently a low-impedance device, and therefore has the advantage of reducing the effect of circuit capacitances on fast rise and fall times. The micro-alloy transistor has been designed specially for this type of work and will operate at pulse frequencies in excess of 20 Mc/s. It is similar to the surface barrier transistor, with an etched-away base region of controlled thickness (about 0.1 mil), but has in addition an extremely thin alloyed junction (about 0.001 mil) which leads to better current amplification than in the surface barrier type. Transistors of this kind will probably become available in Britain later in the year.

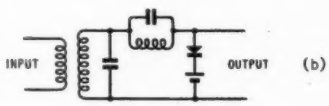
Residual C.R.T. Gases can never be entirely removed because in practice it is not possible to evacuate a picture tube below a pressure of about 10^{-6}mm of mercury and there is always a certain amount of gas liberated after the tube is sealed. Such gases can, of course, shorten the life of the tube by poisoning the cathode. If precautions are to be taken to reduce their generation, it is necessary to know what gases are present in existing tubes and from which components they originate. Philips in Holland have been doing analyses on this question by means of a mass spectrograph called an omegatron, which might be described roughly as a small cyclotron. The principal residual gases found by this method are methane and argon. It seems that the methane pressure falls with the passage of electrons in the tube, but rises again during periods of rest. The argon is present only after vaporization of the getter. What other gases are found depends on the method of manufacture and materials used, but hydrogen, carbon monoxide and carbon dioxide are common. It appears that carbon monoxide and carbon dioxide can be expected in tubes with aluminized screens. The work is described in *Philips Technical Review*, Vol. 19, No. 7-8. It is hoped to obtain quantitative analyses later.

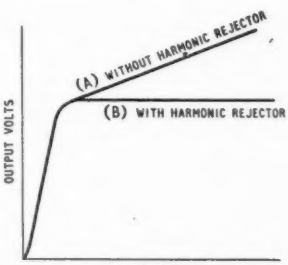
Vacuum Ultrasonic Cleaning technique for metal parts developed by Technochemie of Switzerland is said to offer advantages because of the removal of air from the solvent. Cavitation is claimed to be far more effective, while the removal of air pockets from any intricate component undergoing treatment gives better contact between the solvent and the metal surface. Impacted dirt or other unwanted material in small blind holes in the metal can also be removed by the technique. The equipment, which is available in this country from the Electro-Chemical Engineering Co., uses barium titanate transducers and works on frequencies of 40kc/s and 400kc/s. The process normally includes the additional operations of cleaning before the ultrasonic treatment and rinsing, degreasing and drying afterwards.

X-Raying Miniature Components is being done at the Battelle Institute, on things like diodes, transistors, capacitors and resistors, as a preliminary check on the causes of component failures. Photographic enlargements of the X-ray images about 2½ inches long are made, and are said to yield useful information in 75 per cent of the cases. This technique avoids the risk of destroying the evidence by damage which is possible if the component is opened for inspection. For good resolution a small focal-spot X-ray tube is desirable at a focal-spot-to-object distance of at least 6ft. This tends to collimate the X-ray beam so that after passing through the object it will produce as small a penumbral shadow as possible. A high-contrast, fine-grain film is also desirable for the work.

Tuned F.M. Limiter.—A simple form of limiter suitable for use in f.m. receivers, shown at (a), consists of a diode biased in the reverse direction. As soon as the peak inverse voltage exceeds the bias voltage a large current flows and damps the tuned circuit heavily. The limiting obtained is not, however, perfect, and a typical input-output



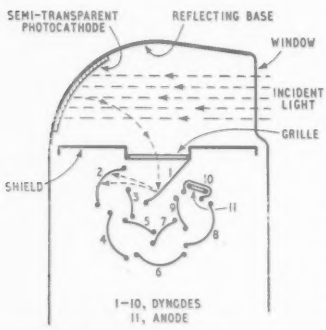




characteristic is shown by curve A in the lower diagram. The circuit has been analysed by C. G. Mayo and J. W. Head, who, in the March issue of *Electronic and Radio Engineer*, describe a simple modification which results in almost perfect limiting. The modification, shown in (b), consists of putting a rejector circuit, tuned to the third harmonic of the input frequency, in series with the limiter diode. The kind of performance obtained is indicated by curve B. The authors discuss the problem of combining the limiter with a discriminator and propose a new variety of

Foster-Seeley discriminator which takes advantage of the low output impedance of this type of limiter. The calculated harmonic distortion in the audio output is very small.

Dormer Window is a distinguishing feature of a new photo-multiplier tube, the type 7029, recently introduced by RCA. The light enters as shown in the sketch and falls on a semi-transparent photo-cathode with reflecting material underneath. Electrons emitted from the photo-cathode pass into the 10-dynode electron



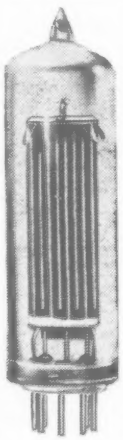
multiplier. This has an arrangement, common to other RCA tubes, whereby the last dynode, No. 10, is shaped so as to partially enclose the anode. It serves as a shield to prevent the fluctuating potential of the anode from interfering with the electron focusing between the other dynodes. (The anode is actually a grating which allows the electrons to pass through it.) As a result, the output current is substantially independent of the instantaneous positive anode voltage over a wide range, and the photo-multiplier can be used with practically any load impedance. The tube is intended mainly for detection of low-level light signals in the presence of relatively high background illumination.

Radar Mapping System, a new form of aerial photography, has been developed by Texas Instruments for the U.S. Air Force. It produces a strip photograph of the picture appearing on the airborne radar screen covering a broad corridor of the terrain below. The system has been called "side looking radar" because the mapped corridor extends out on each side of the aircraft's path.

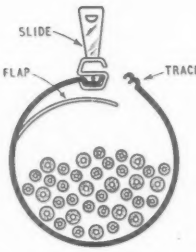
Three-Colour Storage Tube, similar to the shadow-mask colour television c.r.t. in mode of operation but having a long screen persistence of about 1 minute, is described by C. D. Beintema, L. L. Vant-Hull and S. T. Smith in D.S.I.R. unpublished report PB121815*. There are three "writing" electron guns and the perforated shadow mask is arranged so that the electron rays from each gun impinge on a particular set of colour phosphor dots on the screen. In this way it is possible to store electrical signals independently in adjacent colour areas. The tube has 75 colour phosphor dots to the inch and gives a brightness of 8 foot-lamberts.

Simple Diode Fluxmeter described by W. Fulop in the February, 1958, *Journal of Scientific Instruments* is based on the magnetron effect which occurs in the electron trajectories of a diode valve when it is placed in a magnetic field. This reduces the anode current according to the strength of the field. A subminiature diode is rotated in the field on two mutually perpendicular axes until minimum anode current is obtained. The angular co-ordinates of the diode then provide a relative measure of magnetic flux and can be calibrated against a standard.

Low-R Photoconductive Cell of the cadmium sulphide type just introduced by Mullard's will give sufficient current to operate a relay directly with only a low applied voltage. The low resistance is achieved by an interdigital pattern of copper strips on the cadmium sulphide element, as shown in the illustration. Cadmium sulphide cells have only recently become available in commercial form and are notable for their high sensitivity compared with photo-emissive cells and other photoconductive types. They are slower in response than photo-emissive devices, but this particular cell will perform switching operations at speeds up to about 50 per second. With illumination of 5 foot-lamberts, at a colour temperature of 1500°K (reddish yellow light), the cell will give about 20mA for an applied voltage of 10V. From the same illumination but at a colour temperature of 2700°K (yellowish white) the current is approximately 6mA. Doubling the applied voltage gives a four-fold increase of current within the permissible power dissipation, which is 1 watt at 25°C or 200mW at 75°C. The dark current is only 2.5μA (at 25°C) with 300V applied to the cell. Spectral response covers the entire visible spectrum and extends nearly into the infra-red region.



Zip-Fastener Cable Harness made of p.v.c. is a new idea from America for grouping together assorted wires into one main cable. Manufactured by



the Aphlex Tubing Division of Alpha Wire, the "zipper tubing" is available in sizes ranging from ½ inch to 4 inches in diameter (closed) and lengths from 10ft to 1000ft. The two interlocking parts are in the form of continuous mouldings—like the modern plastic slide fasteners used for toilet bags, etc. A flap is incorporated to contain the wires while the tube is being closed up by the slider.

Thermal Image Pick-up Tube, with sufficient sensitivity to detect objects differing by as little as one degree from background temperature, seems a possible outcome of development work described by J. Burns in D.S.I.R. unpublished report PB124111*. It is thought that the tube should be capable of giving a picture of substantially television quality.

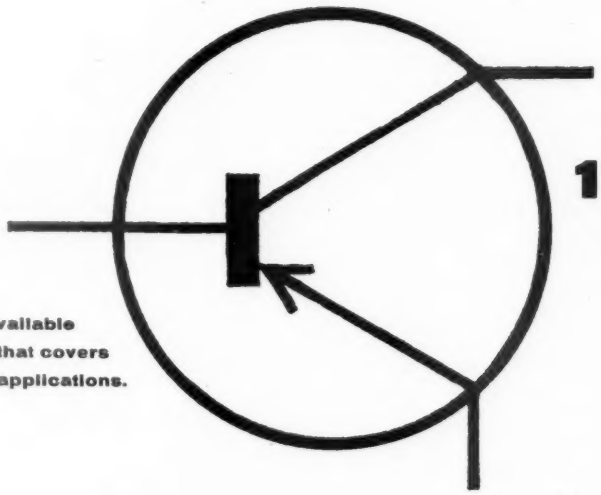
Video Tape Splicing method has been developed by Ampex in the U.S.A. for their television magnetic tape recording machines (in which the signals are recorded in transverse tracks across a 2-inch wide tape, see September 1957 issue, p. 445). The splicing is done along the frame sync pulse lines to give a smooth transition during playback. The position of the frame pulse lines on the tape is found by applying a suspension of carbonyl iron particles to the recorded surface. The iron particles align themselves with the recorded magnetic lines of force, so as to make them easily visible after the rapid evaporation of the suspension medium. Finding the correct lines for splicing is further simplified by identification pulses provided by the recorder. These protrude right to the lower edge of the tape, so that only this part of the surface need be coated with the carbonyl iron.

Feedback in Magnetic Amplifiers is being investigated as a new technique by Remington Rand in the U.S.A. The power gain of the amplifier can be increased, but there remains a finite rise-time limiting the speed of response. Tests made on magnetic amplifiers excited by a sine-wave carrier are described in D.S.I.R. unpublished report PB123403*.

* Obtainable from the Lending Library Unit of the D.S.I.R., 20 Chester Terrace, Regent's Park, London, N.W.1.

Three things you should know about EDISWAN transistors

MAZDA



1 More and more manufacturers are specifying them.

2 They are available in a range that covers numerous applications.

3 Their prices are competitive.

Your reference files are incomplete

unless they include our latest folder of Ediswan Mazda PNP Junction Transistor Data.

May we send you a copy?

SIEMENS EDISON SWAN LIMITED

An A.E.I. COMPANY

155 Charing Cross Road, London, W.C.2, and branches

Telephone: GERrard 8660. Telegrams: Sieswan Westcent, London

CEC 15/11

H

EMI

"HIS MASTER'S VOICE"
MARCONIPHONE · COLUMBIA

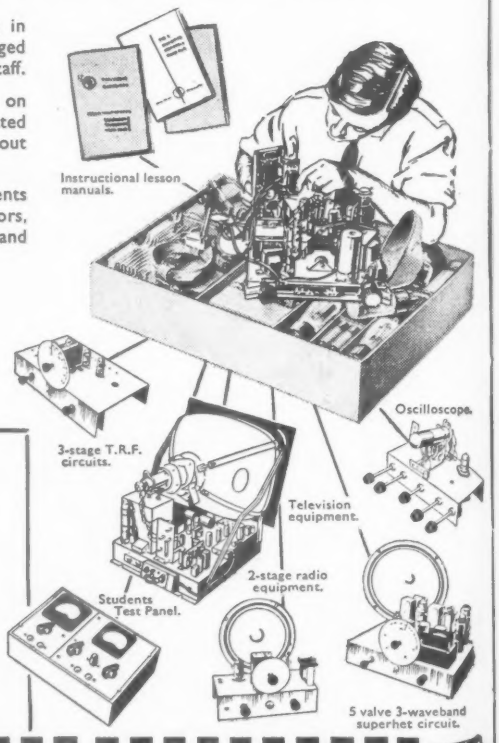
Announce NEW PRACTICAL WAY OF LEARNING AT HOME

NEW — completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW — experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

Radio and television courses, with which specially prepared components are supplied, teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern Radio and T/V equipments.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.



Courses with Equipment

RADIO • SHORT WAVE RADIO
TELEVISION • MECHANICS
CHEMISTRY • PHOTOGRAPHY
ELECTRICITY • CARPENTRY
ELECTRICAL WIRING
DRAUGHTSMANSHIP • ART etc.

E.M.I. Factories at Hayes, England

EMI INSTITUTES

Fill in for FREE BROCHURE
E.M.I. INSTITUTES, Dept. 127x, London, W.4.

FREE

Name .....
Address ..... Age (If under 21)
BLOCK CAPS PLEASE

I am interested in the following subject(s) with/without equipment

APR 58 (We shall not worry you with personal visits) C107

The only Home Study College run by a World-wide industrial organisation

Transmission-Line Calculator

Device for Finding the Length of Terminated Lines at Specific Frequencies

By J. H. ANDREAE*, Ph.D.

THIS device has been found useful for calculations on low-loss resonant transmission lines in the course of ultrasonic research above 50Mc/s. It is based on the well-known formula for the reactance X at a distance x from a short-circuit along a line of characteristic impedance Z_0:—

$$X = Z_0 \tan(2\pi x/\lambda) \quad .. \quad .. \quad .. \quad (1)$$

where λ is the wavelength.

The multiplication of Z_0 by $\tan(2\pi x/\lambda)$ is effected by the slide-rule principle, in fact, by adding their logarithms:—

$$\log_{10}X = \log_{10}Z_0 + \log_{10}\tan(2\pi x/\lambda) \quad .. \quad (2)$$

The characteristic impedance Z_0 is set on a sliding logarithmic scale (A in the illustration), while $\tan(2\pi x/\lambda)$ is given by the curve B engraved on the Perspex disc D. This curve is a polar plot of the function $\log_{10}\tan(\theta/2)$ against the angle θ. $\theta/2$ represents $2\pi x/\lambda$ so one complete rotation of the disc ($\theta = 0$ to 2π) corresponds to a change in x of $\lambda/2$, or half a wavelength.

The disc D is 12in in diameter and $\frac{3}{16}$in thick and has a reference circle E engraved on it at a radius of 4in. The radial scale for the polar curve of $\log_{10}\tan(\theta/2)$ is identical with that for the $\log_{10}Z_0$ scale (a decade extending over 2in) and the curve B is measured from the reference circle so that a radius r measured from the centre of the disc to the curve is given by:—

$$r = 4 + 2\log_{10}\tan(\theta/2) \text{ inches} \quad .. \quad .. \quad (3)$$

Since the reactance at a point on the transmission line is usually required in terms of an inductance L or a capacitance C, a second rule F is provided for converting the reactance in ohms directly into an inductance in microhenries, or a capacitance in picofarads. Taking logarithms of the formulae:—

$$X = 2\pi fL \quad .. \quad .. \quad .. \quad .. \quad .. \quad (4a)$$

and

$$X = 1/2\pi fC \quad .. \quad .. \quad .. \quad .. \quad (4b)$$

we find that

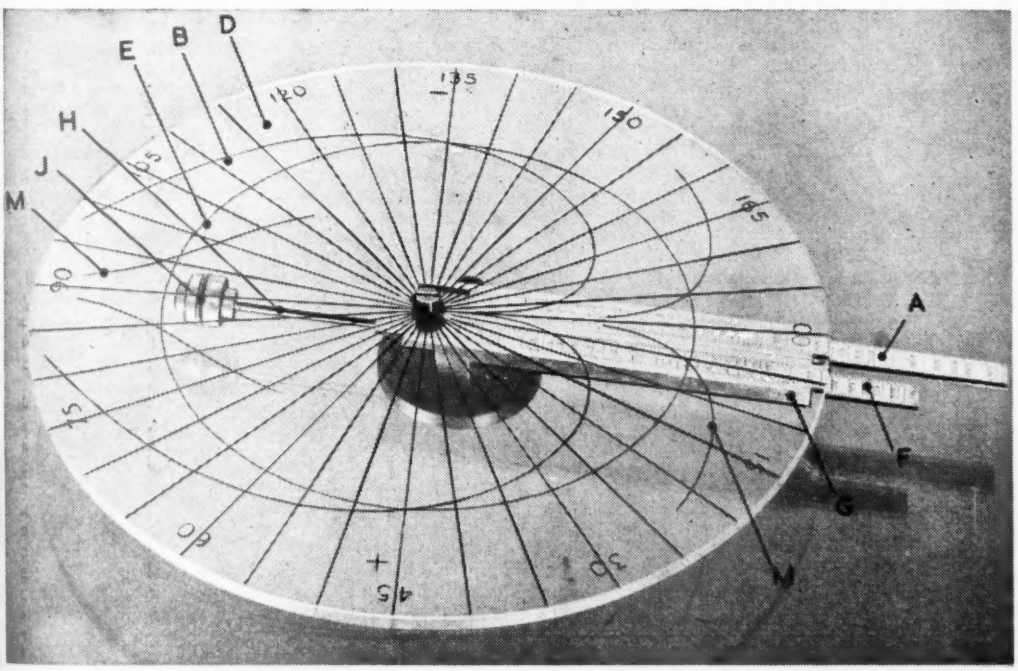
$$\log_{10}X = \log_{10}2\pi + \log_{10}f + \log_{10}L \quad .. \quad (5a)$$

and

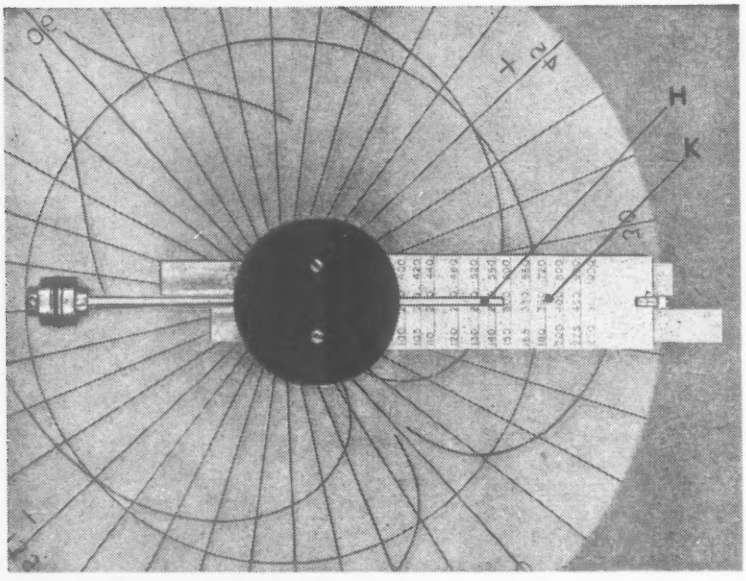
$$-\log_{10}X = \log_{10}2\pi + \log_{10}f + \log_{10}C \quad .. \quad (5b)$$

The rule F is graduated with two scales in opposition, one giving the frequency f and the other giving the inductance or capacitance. The two scales are displaced by the amount $\log_{10}2\pi$ and, because of the

*Imperial Chemical Industries Ltd., Research Department.



Top view of calculator showing the engraved Perspex disc with the "slide-rule" unit mounted underneath it.



Underside of calculator showing base rest and reverse of "slide-rule" unit.

negative sign in equation (5b), the rule is reversed when capacitance, rather than inductance, is being measured. The rule is reversed by pulling it out and inserting the other end first.

In order to change ohms into microhenries, the frequency end of the rule F is inserted into the rule case G and the appropriate frequency is lined up against the mark L on the rule F. (The mark L is placed at 1,000 ohms and this allows for the conversion of henries to microhenries.) Now the inductance in microhenries can be read off the rule F for any value of the reactance in ohms on the rule A. Similarly, for conversion to picofarads the rule F is reversed and the frequency is set against the mark C which corresponds, conveniently, to the end of the rule.

In addition to the rules A and F the rule case G carries the arm H, on one end of which runs the wheel J. The other end of the arm acts as a pointer on the frequency scale K, which is engraved on the under side of the rule case. The rubber-tyred wheel J rolls on the disc D at a radius which is determined by the position of the other end of the arm H on the frequency scale K. For one complete rotation of the disc (*i.e.* one half wavelength) the wheel performs:—

$$n = R/r \quad .. \quad .. \quad .. \quad .. \quad (6)$$

revolutions, where R is the radius of the circle on which the wheel rolls and r is the radius of the wheel. The scale K is calculated from equation (6), the length of the arm H, the number of graduations on the wheel and the formula:—

$$\lambda = \frac{3.10^{10}}{f\sqrt{\epsilon}} \text{ cm} \quad .. \quad .. \quad .. \quad .. \quad (7)$$

where ϵ is the dielectric constant of the medium separating the conductors of the transmission line. For the device shown, a wheel of 1cm radius is used and two scales are engraved on it, one giving 6 divisions per revolution and the other 4 divisions per revolution. Each division corresponds to an increase of x in formula (1) by one centimetre and is divided into tenths. The 6-division scale is employed for air-dielectric transmission lines and the 4-division scale is used for lines with a polythene dielectric. Polythene has a dielectric constant of $\epsilon = 2.3$, so $\sqrt{\epsilon} = 1.5$ and 6/4 is a good approximation to the ratio of the wavelengths in air and polythene. (When other dielectric media are encountered a separate frequency scale K may be provided, or the number of divisions "rolled out" by the wheel on the 6-division scale can be divided by $\sqrt{\epsilon}$.) When the pointer end of the arm H is moved to the required frequency on the scale K and the disc is rotated through 360°, the appropriate wheel scale should roll out the distance x to one half wavelength in centimetres.

So far it has been tacitly assumed that the transmission line is terminated in a short-circuit. When the line is terminated in a reactance X_T, this termination is imagined to be replaced by a length of short-circuited line showing the reactance X_T at its open end. Then, instead of setting the calculator to the short-circuit position and rolling out the length of the line, we start from the angular position of the disc at which the curve B indicates the reactance X_T on the Z_o-rule A.

The calculator has been designed for anti-clockwise operation and that half of the curve B which passes over the rules immediately after the short-circuit position 0° is marked positive, the other half negative. The sign of the reactance changes both at the short-circuit position and also at the open-circuit position 90°.

To extend the curve B near the short-circuit and open-circuit positions, additional curves M are provided which represent parts of the curve B multiplied by 10 and divided by 10, respectively. When using these extension curves the values indicated by the scales on the rules A and F should be increased or decreased by a decade as appropriate.

A Problem.—The scope of the calculator may be illustrated by describing the procedure for solving a particular problem. A push-pull, resonant line oscillator was constructed for operation between 150 and 500Mc/s using a double-tetrode valve type QQVO6-40 and described elsewhere in this issue. Three anode lines of characteristic impedance 75 ohms, 150 ohms and 250 ohms, respectively, were employed. The inter-anode capacity of the valve was measured and found to be 2pF and the characteristic impedance of the line formed by the anode pins was calculated to be 350 ohms. We shall consider the case of the 75-ohm line only since a similar procedure applies to lines of other impedance. The problem is to calculate the length, in centimetres, of

the anode line over the frequency range from 150 to 500Mc/s on the assumption that it is short-circuited at one end and terminated at the other end by a 2-cm length of 350-ohm line and a 2-pF capacitance.

The procedure is as follows:—

(i) Set the pointer on the frequency scale K to, say, 200Mc/s.

(ii) Set the Z_0-rule to 350 ohms on the reference circle.

(iii) Set the frequency, 200Mc/s, on the rule F against the mark C on the rule A.

(iv) Rotate the disc until a point on the negative half of the curve B indicates 2pF on the rule F.

(v) Set the wheel J so that the zero graduation is visible just under the disc D.

(vi) Rotate the disc until the graduation 2 appears just under the disc. The reactance −330 ohms, indicated now by the curve B on the Z_0-scale, is that at the junction point between the 350-ohm and 75-ohm lines, looking into the 350-ohm line.

(vii) Set the Z_0-rule to 75 ohms on the reference circle.

(viii) Rotate the disc until the curve B again reads −330 ohms on the Z_0-scale.

(ix) Set the wheel to zero as in (v).

(x) Rotate the disc to the short-circuit position, counting the number of centimetres rolled out by the wheel on the 6-division scale (x = 32cm.).

(xi) Repeat for other frequencies between 150 and 500Mc/s until a smooth curve can be plotted. The whole curve can be evaluated in about 30 minutes.

This problem illustrates the ease with which the operator can change from one characteristic impedance to another, while working directly in megacycles per second, centimetres, picofarads and microhenries.

A more complicated version of the calculator, capable of dealing with resistive terminations and with lossy transmission lines, has been described before†. In practice, these elaborations have been seldom used and they were omitted when the calculator was reconstructed in its present, improved form.

† J. H. Andreae, Ph.D. thesis, London, 1955.

Exponential Horn Dimensions

Calculations for Ribbon Loudspeakers

By J. R. G. TWISLETON, B.Sc., A.M.I.E.E.

SOME time ago when the writer constructed a pair of exponential horns for a ribbon loudspeaker, for which a design has previously been given in *Wireless World*[1], it was found convenient to calculate the dimensions of the sides of the horn rather than use the geometrical method of development suggested in the article. This enables the outline of the sides to be marked directly on the material to be fabricated, or, alternatively, on to suitable templates for the sides.

The calculation is given for horns of rectangular cross-sections[2], and the nomenclature used is that of the previous article[1]. Thus, the throat dimensions of the horn are a and b, and the corresponding dimensions at an axial distance x from the throat are $a_x = ae^{m_a x}$ and $b_x = be^{m_b x}$. It is clear that at the point x, where the width of one side of the horn is a_x, the length of the side is not x but the distance along the curve $b/2 \times e^{m_b x}$. Similarly at the point where the width of the adjacent side is b_x, the length of that side is the distance along the curve $a/2 \times e^{m_a x}$.

The length of these curves can be readily obtained by integration[3], when it is found that for the side of width a_x the developed length b'_x corresponding to an axial length x is given by

$$b'_x = \frac{1}{2m_b}\left\{\log_e\left[\frac{(\eta-1)}{(\eta+1)}\left(\frac{\eta_0+1}{\eta_0-1}\right)\right] + 2(\eta-\eta_0)\right\} \quad \ldots \quad (1)$$

where $$\eta = \left[1+\left(\frac{bm_b}{2}e^{m_b x}\right)^2\right]^{\frac{1}{2}},$$

and $$\eta_0 = \left[1+\left(\frac{bm_b}{2}\right)^2\right]^{\frac{1}{2}} \quad \ldots \quad (2)$$

Equations (1) and (2) also give the developed length a'_x of the side of width b_x if for b'_x, b and m_b are substituted a'_x, a and m_a respectively.

Practical Example.—Consider a horn having a cut off frequency of 900 c/s, and throat dimensions a = 1.375in and b = 0.375in. The exponent $m_a + m_b$, which is equal to $4\pi f_c/13{,}500$ where f_c is the cut off frequency, is 0.84 per in. Thus, choosing m_a = 0.36 and m_b = 0.48, the mouth dimensions are 9.25in and 5.0in for an axial length of 5.25in. The dimensions of the sides in inches, calculated from the formulae using a slide rule, are given in the following table, η_0 being the value of η where $x = 0$, i.e. the first value of η given in the table.

x	0	0.75	1.5	2.25	3.0	3.75	4.25	5.0	5.75
a_x	1.375	1.80	2.36	3.10	4.06	5.36	6.38	8.38	11.0
η	1.004	1 008	1.016	1.035	1 072	1.138	1.2	1.41	1.785
b'_x	0	0.8	1.52	2.30	3.12	3.91	4.43	5.21	6.7
b_x	0.375	0.54	0.74	1.10	1.60	2.27	2.76	3.70	5.92
η	1.031	1 052	1.086	1.147	1.24	1.39	1.53	1.82	2.23
a'_x	0	0.76	1.52	2.39	3.28	4.28	5.0	6.25	7.78

In the calculation no allowance is made for any flaps to hold the sides together, but this can be taken care of when the sides are marked out.

It may be noted that if the horn is to be subdivided into cells, the dimensions of the internal partitions required may be calculated in the same way as for the sides by using the appropriate values for a and b.

[1] P. L. Taylor, Ribbon Loudspeaker, *Wireless World*, Vol. 57, No. 1, p. 7 (Jan. 1951).

[2] A treatment for exponential horns of square cross section has been given by G. H. Logan in *Electronics*, Vol. 12, No. 2, p. 33 (Feb. 1939).

[3] See for example, Toft and McKay, "Practical Mathematics," Ch. XI (Pitman 1942).

Re-charging Primary Cells

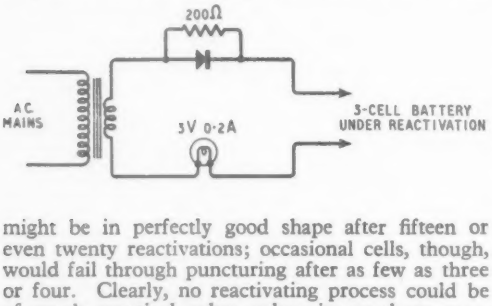
Further Notes, Including Results with Leakproof Units

By R. W. HALLOWS, M.A. (Cantab), M.I.E.E.

FOR a good many years now the investigation of the possibility of reactivating the dry Leclanché cell has been one of my spare-time diversions. The chemical reactions which take place inside such a cell are actually considerably more complex than the simple equations given in many text books suggest. But the key reaction is the chemical conversion of zinc abstracted from the inner walls of the can and ammonium chloride into zinc chloride and ammonia, and since this is the exact opposite of an electro-plating process, it seemed more than likely that it should be possible to reverse the reaction successfully—if only one could find out how to do it.

Experiments in which reverse d.c. was passed through partly discharged cells were to some extent successful*; but one very serious snag was encountered. Zinc was certainly redeposited on the inner walls of the can, but not always in a satisfactory way. Instead of being hard, smooth and evenly distributed, it was inclined to be soft, lumpy and uneven. The inevitable result was that after a varying number of reactivations thin spots developed and eventually puncturing, or even bursting of the can occurred.

The big trouble was that it was quite impossible to predict the life of such reactivated cells. One



might be in perfectly good shape after fifteen or even twenty reactivations; occasional cells, though, would fail through puncturing after as few as three or four. Clearly, no reactivating process could be of much practical value unless its products were reliable. It certainly costs far less to reactivate a cell than to buy one; but it is a much more economical business to throw run-down cells away and invest in new ones than to have expensive apparatus ruined by the horrible mess which exudes from a punctured can!

Results showing a distinct improvement were obtained when a trickle charger with no smoothing circuit was used for the d.c. supply. But here another trouble was apt to arise: unless one was very careful cells under charge became far too hot and there was evaporation of moisture from the electrolyte. Still, there was an improvement in the quality of the redeposited zinc. This was undoubtedly due to the roughness of the d.c. and I have kicked myself not a few times since for having failed to try the effect of a little superimposed a.c.

Then in 1954 a Dutch engineer, Mynheer Beer, was kind enough to send me particulars of a device developed by him and known as the "Electrophoor" which was extensively used in the Netherlands. The inventor was also kind enough to let me have an "Elektrophoor" suitable for dealing with three cells of the Eveready U2 or Vidor Monocell size. The apparatus was described in *Wireless World*†. In case any readers have not access to that issue (and to save others the bother of turning up the reference!) the circuit diagram is reproduced on this page.

It will be seen that the rectifier is shunted by a 200-250 Ω resistor which allows a certain amount of a.c. to pass. The input to the cells under treatment resembles, as I wrote originally, "very dirty d.c." The waveform, as shown by the oscilloscope, consists of a shortish peaky positive "half-cycle," followed by a shallow negative trough of longer duration. It is, in fact, as correspondents showed‡, very similar to those used in the periodic reverse (P.R.) system of electro-plating, by which even deposits of metal up to 0.5 inch in thickness can be obtained. One's biggest surprise on opening the can of a cell which has been many times discharged and subsequently reactivated by the "Elektrophoor" is to find as a rule no trace of lumpy or spongy deposits, but a hard, even inner surface.

The superimposed a.c. not only produces this most desirable result, but also speeds up the process of depolarization and makes it more complete.

The otherwise charming little town in which I live has not the best of street lighting; and I make a great deal of use of a 3-cell flashlamp after sunset during the darker months of the year, that is between mid-September and mid-April. One set of cells lasted me right through what I call the flashlamp season of 1954-55. They were thrown away in April, not because they were in poor condition—the e.m.f. and internal resistance could still be brought back by reactivation to something very close to their original values—but because I was afraid that I might forget to give them an occasional "pep-up" and that there might in consequence be a regrettable incident.

The same thing took place in 1955-56 and 1956-57 and these experiences have already shown that, for seven months on end, at any rate, the dry Leclanché cell can be used precisely and exactly as if it were a secondary cell.

Last autumn, leakproof cells were once more available. Three of these (LPU2's) have been in regular use since last September and it seems likely that they may continue to give good service from

* See "Reactivating the Dry Cell." R. W. Hallows, *Wireless World*, August, 1953, p. 344.

† "Dry-cell Reactivator." R. W. Hallows, *Wireless World*, October, 1955, p. 503.

‡ A. F. Standing and George E. Smythe, *Wireless World*, December, 1955, p. 606.

year to year. That rather depends on just how far a leakproof cell *is* leakproof. Wanting to find out, I have deliberately bullied some of them in an almost brutal way—without, so far as can be detected, any untoward results. Some have been grossly overcharged for 36 hours or more on end. Others have been baked in the oven for three hours until they were much too hot to be handled with bare fingers. But they always seem to come up smiling again after such ordeals and quickly settle down to working as well as ever.

I calculate that during the 200-odd days between the middle of September and the middle of April when they are in regular use the flashlamp cells are under discharge for a total of not less than 150-160 hours. The load being 0.25A, that comes to 37½-40 ampere-hours, with the cells apparently still in excellent condition. This, you must admit, is no mean performance.

Since these experiences extend at the moment of writing over the autumns, winters and springs of just on four years, one feels that the method of reactivation by d.c. with superimposed a.c. has amply proved its value.

It has been suggested by correspondents connected with the electro-plating industry that even better results might be obtainable if the source of the reactivating current were something different from 50 c/s mains a.c. It might be preferable, they think, to use a current of less rapid periodicity and in particular to make the negative troughs applied to cells under charge shallower and of much longer duration.

If any reader feels so minded and has the necessary facilities available, here is an interesting field for experiment. Myself, though, I fancy I shall remain content with the results obtained with the 50 c/s a.c. so conveniently supplied by the mains.

Valves Galore

—And Some Notes (Mostly Sour) on Series-Heater Circuits

*By JACK DARR**

Although series-heater radio receivers are common in America, the low mains supply voltage has until recently prevented the use of this technique for TV receivers. Now that suitable power rectifiers and capacitors are available (voltage-doubling for the h.t. line is universal) series-heater TV receivers are becoming common. This article deals with some of the servicing problems that Americans are meeting for the first time.

AMONG some of the more entrancing features of Life In These United (more or less) States is the opportunity of repairing some of the weird circuits used in the manufacture of radio and TV receivers. Probably the principal factor in the design of much of our mass-produced equipment is economy of construction. This accounts for the Printed Circuit, anathema to most service technicians, but beloved of the development men and accounting departments because of their cheapness of manufacture. Another is the Series Heater Circuit.

This arrangement, identical with that used in the older strings of Christmas-tree lights, was developed to eliminate the need for a mains transformer. Of late, it has resulted in the introduction of some of the most weird heater-voltages imaginable! The technician comfortably puttering around in a new set, accustomed to such sensible types as the 6BQ6GT (a very popular line-scan output tube), now finds himself staring in horror at such cute little numbers as 12BQ6GT, 14BQ6GT, 17BQ6GT, 19BQ6GT, and even a 25BQ6GT. These are accompanied by such items as the 12AX4 and 19AU4 for dampers (efficiency or boost diodes). Perhaps because of its retiring disposition, always hiding shyly in the box screening the line-scan output transformer, the EHT rectifier has somehow escaped notice, and remains the old and faithful 1B3! It is quite heartening to the technician to find at least *one* valve (tube to us!) in the set with a number he has seen before! (and is likely to find in his tube-kit!).

In other parts of the set, the same confusion prevails. I.F. stages, in the Good Old Days, used such types as the 6AU6, a sharp-cut-off pentode, with perhaps a 6CB6 in the first stage, for a.g.c. purposes. Now, upon lifting the screens from the i.f. tubes, we find a group of such Little Monsters as 3CB6, 4BZ6, 5AU6, 7AU7 *etc.* Oops! Pardon me. I'm a bit confused; the 7AU7 is not found there, but is a replacement for our old familiar friend, the 6SN7. It has a large family, too; 14AU7 *etc. etc.*

Sync separators, clippers *etc* are inhabited by another strange tribe; 5U8's, 5AN8's, 7AW8's, 3BN6's, while audio output and other chores are handled by 5AQ5 and 5BK5. Vertical oscillators find themselves crowded into one bulb with the output triode in the 6CM7. This novelty combines one 6J5 and one 6SN7, or half of it, all in one tiny bottle!

In the tuner, to use a native expression, they have gone simply "hawg-wild!" Replacing the old, familiar and highly efficient 6BQ7-6BK7 *et al*, we find, if I may be permitted an atrocious pun, a perfect "cascade of cascodes"; 3BQ7, 4BK7, 5BZ8, 5CL8, 5AT8, 4BS8, 5CG8, on and on *ad infinitum* until one

* Ouachita Radio-TV Service, Mena, Arkansas.

wonders where they get all the new letter combinations! Also prominent among such types are the new triodes—the 2BN4 is one. This is employed in a new type of tuner which is the only tuner giving less snow when the r.f. tube is removed from the socket! A 2AF4 is used in u.h.f. tuners and was the source of much grief during its formative years; later production changes have ironed out some of the bugs, and they work very well now.

Mixer-oscillators, beginning with the old faithful 6J6, have changed to a triode-pentode combination, using a 6U8 in the beginning: these were soon replaced by 5U8, 5AT8, 5CG8, 5BS8 *et al.*

The Reason For The Change:—There was actually a bit of good reasoning behind the development of these odd-numbered valves. They do have two things in common; their filament current and their "warm-up" time. These are 600 mA and 11 seconds, respectively. This was done intentionally; the picture tubes all have 6-volt heaters, with 600-mA current and (now) an 11-second warm-up time. (How they've overlooked them in the stampede to make odd-voltage tubes, I shall never know!) When used with the remaining tubes, this created quite a few rather unseemly series-parallel heater circuits. For instance, many sets used a dual-string arrangement, with 300 mA tubes in each branch, meeting at the c.r.t. heater for the first time, where the currents flowed together through its heater back to earth.

The difference in warm-up time created quite a bit of confusion and service difficulties in the older sets. Older tubes were quite individualistic about this parameter; they arrived at their operating temperature when and if they jolly well got ready, regardless of what was going on in other parts of the circuit. For instance, if the line-scan output tube got ready to go a bit early, no drive was available from the oscillator, if that worthy happened to be a bit slow in waking. This resulted in a severe overload in the anode circuit with occasional failures of fuses and much puzzling on the part of the service technician as to just what had caused the fuse to let go.

The first corrective measure applied to this problem was the inclusion of a special resistor in series with the heater string. This blob of thyrites had a negative temperature coefficient, which gave it a whacking great resistance when cold, up into hundreds of ohms, dropping to a quite low resistance when heated up. This unit was called an NTC resistor by the trade and several mouth-filling names by the advertising gentry ("Magic Tube Saver," *etc*). It caused a delay in the warm-up time by limiting the current which could be drawn initially. This eliminated one very bad feature, the unequal loading, which caused some valves to suffer as much as a 400% overload while others were underheating, resulting in amazingly short tube lives!

By making all of the tubes with identical current drains and warm-up times, the designers were able to string them all together like a tremendous Christmas-tree light string.

This "controlled warm-up" feature eliminated not only the resistor, but also speeded up the overall time required to get the thing into action. Using large NTC resistors it often required a minute and a half to get a picture on the screen; the new types will start the set to work within about 30 seconds. This makes the customer much happier; with the old types he often missed the opening commercial!

The "Line-Connected" Chassis and Shock Hazards:—Another feature of the series-connected set is the need for using what is known among the setmakers as a "line-connected" chassis and among servicemen a "Death-trap." Instead of the familiar mains transformer and rectifier tube, we now find all sorts of arrangements, mainly using selenium or silicon rectifiers in half-wave and full-wave voltage doubler circuitry. The most charming feature of these arrangements is that they seem to require that one side of the circuit be connected directly to the a.c. mains (line). The inevitable result of this arrangement is that if the line plug is inserted a certain way, the full line voltage is present between the chassis and the nearest grounded object (which is generally the serviceman, but may be, on occasion, the *customer!*)

One delectable version of this was encountered recently by the writer while servicing one of these chassis. Touching the earthed antenna lead and the chassis gave a vicious shock. After reading a few appropriate verses from the Koran *etc*, the luckless wight reversed the plug and returned to his task, only to be unceremoniously removed from his stool and deposited on the shop floor when he again managed to complete the circuit between the chassis and antenna, this time with the elbow! Investigation (using a voltmeter) resulted in the shocking (oh!) disclosure that this little gem was hot—with the full line voltage to ground—in *both* positions of the plug!

All levity laid aside for the moment, a very serious problem does exist. This applies not only to the technician but also to the user. For economy again some of these sets have been housed in metal cabinets. Of course, in compliance with the Underwriters' regulations, insulation is provided between chassis and cabinet. However there are some models in which this insulation seems to be entirely inadequate. Careless service procedure, owner tinkering *etc* can nullify even this slight degree of protection by allowing self-tapping screws, stray bits of metal or any other conductor to fall into the small spaces between chassis and cabinet, causing a short-circuit. Insulation which breaks up or fails when the chassis is removed and replaced, can cause the same trouble. Several accidents, including two deaths of set users, have resulted from this cause.

The serviceman shares to some degree the manufacturers' responsibility for prevention of possibly fatal shocks, both by checking insulation when the set is serviced, and by warning the set-user of the dangers inherent in use of the apparatus on damp concrete floors, or out in the yard, on damp ground, near grounded metal cabinets such as sinks or bath fixtures, *etc*. It is to be hoped sincerely that some safe solution to this hazard can be worked out very soon; after all, good customers are hard to find and we cannot afford to lose very many of them!

The "Needle-in-the-Haystack" Feature:—There is one unmistakable characteristic of the series-heater set, displayed when a valve happens to reach the end of its useful life, and passes to its ancestors. *Everything* goes dead! No sound, no picture, no raster, no pilot light, "no nuthin." Of course, as a few unwary souls have discovered, there remains a nice unloaded potential of a few

(*Continued on page* 197)

Vortexion quality equipment

Model W.V.B.

Many years of steady development have enabled us to still further improve the Vortexion W.V.A. and W.V.B. recorders which are now fitted with clock type position indicators.

All components which could contribute to noise or reliability are carefully measured and selected individually before incorporation, resulting in an exceedingly low background noise and distortion with frequency response within ± 1.5 db 50-10,000 c/s and ± 3 db 40-12,000 c/s.

★ The meter fitted for reading signal level will also read bias voltage to enable a level response to be obtained under all circumstances. A control is provided for bias adjustment to compensate low mains or ageing valves.

★ A lower bias lifts the treble response and increases distortion. A high bias attenuates the treble and reduces distortion. The normal setting is inscribed for each instrument.

★ The distortion of the recording amplifier under recording conditions is too low to be accurately measured and is negligible.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load. This is equivalent to 20ft. from a ribbon microphone and the cable may be extended 440 yds. without appreciable loss.

★ The 0.5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 4 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ The play back amplifier may be used as a microphone or gramophone amplifier separately or whilst recording is being made.

★ The unit may be left running on record or play back, even with 1,750ft. reels, with the lid closed.

Our specialised MONITOR HEAD MODEL W.V.B. has an additional head and amplifier which enables this recorder to perform a number of useful functions. The most important of these is to monitor the recorded tape a fraction of a second after it is made, and if necessary compare it by throwing a switch, with the signal before it is recorded. This allows the recording engineer to make certain that he has made a first class recording before the artists leave the studio, without the necessity of waiting while another run through is made.

Additional items may be recorded one on top of another while listening to the first, since a switch is provided for the erase, and the bias, which also acts as a partial erase, can be lowered slightly and its new value checked on the meter. In a similar manner the original signal may be fed back and recorded, resulting in an echo, the time constant of which is controlled by the speed of the tape and the distance apart of the heads.

VORTEXION RECORDERS use a synchronous capstan motor to ensure accurate recording and play back speed.

A Power Supply Unit is available to operate these recorders from a 12 v. car battery giving an output of 120 watts at 230 v., 50 c/s ±1%.

Full details and prices of the above on request.

VISIT OUR DEMONSTRATION ROOM No. 217 at the LONDON AUDIO FAIR

April 18, 19, 20 and 21. Waldorf Hotel, London, W.C.2, where we are also showing **12-CHANNEL and 4-CHANNEL ELECTRONIC MIXERS.** These have 30-50 ohms balanced line microphones or special impedances to order. Normal output 0.5 v. on 20,000 ohms but 1 mW, 600 ohm balanced or unbalanced is available as an alternative.

THE 3-CHANNEL MIXER AND PEAK PROGRAMME METER

is similar to the above but is fitted with a meter reading peak signals with 1 second decay time and calibrated in dbs from zero level 1 mW, 600 ohm. to +12 and −20 balanced or unbalanced output by means of switch.

Several models of High Fidelity Amplifiers from 10-50 watts are also available with less than 0.1% distortion and response level 20-50,000 c/s within 0.2 db.

VORTEXION LIMITED,

257-263, THE BROADWAY, WIMBLEDON, LONDON, S.W.19

Telephones: LIBerty 2814 & 6242-3 Telegrams: "Vortexion, Wimble, London."

Train for a wonderful future in ELECTRONICS...

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial automation are rapidly expanding and the trained specialist assures for himself a well-paid career in this quickly developing profession. Here is your opportunity to enter for:—

3 YEAR COURSE TELECOMMUNICATIONS — Entrance standard G.C.E. Ordinary level or equivalent. This course trains students to become Assistant Development Engineers. It covers the City and Guilds' Full Technological Certificate in Telecommunications Engineering. It also includes theoretical and practical instruction on Computers (Digital and Analogue), Process Control and Automation. Next course commences September 9th, 1958.

1 YEAR COURSE Full-time day course in the Principles and Practice of Radio and Television. Designed for the training of Radio and Television Servicing Engineers and others similarly engaged in the Electronics industry. Next course commences May 28th, 1958; others in September and January.

The E.M.I. College of Electronics, Dept. 127, 10 Pembridge Square, London, W.2
Telephone: Bayswater 5131/2

The College is part of the E.M.I. Group . . . Britain's foremost electronic engineers . . . Pioneers of the world's first public Television Service.

THE E.M.I. COLLEGE OF ELECTRONICS

IA63

WESTON PORTABLE INSTRUMENTS

Weston Portable Instruments include D.C. moving coil, A.C. rectifier and H.F. thermocouple types, and instruments of the A.C./D.C. moving iron type; high grade dynamometer models are also available.

Illustrated above is the Model S.82—a permanent magnet, moving coil instrument in the Portable range. This is primarily a Precision Grade instrument but can also be supplied with Industrial Grade accuracy. Details of this Model, together with others in this series, are available on request.

SINGLE PHASE AND POLYPHASE WATTHOUR METERS
SYNCHRONOUS TIME SWITCHES
SYNCHRONOUS MOTORS AND MOTOR UNITS

SANGAMO WESTON

PANEL & SWITCHBOARD INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple A.C./D.C. Moving Iron

PORTABLE INSTRUMENTS
D.C. Moving Coil, A.C Rectifier, H.F. Thermocouple A.C./D.C. Moving Iron, A.C./D.C. Dynamometer

LABORATORY STANDARD INSTRUMENTS
D.C. Moving Coil, A.C./D.C. Dynamometer

CURRENT TRANSFORMERS . FREQUENCY METERS . ALL-PURPOSE TEST SETS
AIRCRAFT INSTRUMENTS . RATIOMETERS
TACHOMETERS . WESTON STANDARD CELLS . ELECTRICAL THERMOMETERS
"PHOTRONIC" PHOTO ELECTRIC CELLS
PHOTOMETERS

SANGAMO WESTON LIMITED
ENFIELD · MIDDLESEX
Telephone: ENField 3434 (6 lines) & 1242 (6 lines) *Grams:* Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire
Port Glasgow 41151

Branches: London, CHAncery 4971
Glasgow, Central 6208 . Manchester, Central 7904
Newcastle upon Tyne, Newcastle 26867
Leeds, Leeds 30867 . Liverpool, Central 0230
Wolverhampton, Wolverhampton 21912
Nottingham, Nottingham 42403
Bristol, Bristol 21781
Southampton, Sotton 23328
Brighton, Brighton 28497

SW/35

hundred volts of "B+," floating about in the circuit. This is usually quite accessible at such points as the scanning yoke, the (exposed) rectifiers and especially at the new type of fuse used in most sets; all these are installed in the chassis with the hot end out! "Werry Handy," as Sam Weller would say. Aside from this a silence and darkness, as of the grave, prevails.

This brings up a knotty problem. From past experience the technician knows that one of the valves has passed to that bourne from which none returneth, but the problem is "Which One?" With the old faithful parallel-heater sets, this was the simplest of operations; the extinct item was advertised by its absence of illumination. Even a faulty metal tube could be located in a moment or two by touching it; the dead one was cold.

No such bed of roses for our modern technician! His the task of isolating one dead tube from a string of possibly 18-20, all equally cold and silent. Of course, there is always the dogged method of beginning at one end of the string and testing each in turn until the dead one is located. This inevitably results in it being found at the *other* end of the string, no matter at which end tests were started. (Some technicians have tried a method of random selection, hoping to catch the bad one by surprise, as it were; this gives the same result.) This is a time-consuming process, and considering the almost entirely inaccessible locations of many tubes, a difficult one. Incidentally there is a firm belief current among American technicians that the egg-heads at each factory have a special department, known as the "Dirty-Trick" section, which specializes in unlikely and inaccessible locations for tube sockets! They love such didoes as locating the audio output stage just below the bell of the c.r.t., so close that the bottle must be bent sidewise to remove it. Between this and the back of the set is the exposed e.h.t. rectifier and line-scan output tube which must be reached over to gain access to the a.f. output. These are either very hot or very charged, with results which may be left to the imagination. Undisputed champions in this category are the designers of a famous 1952 model, which had the e.h.t. rectifier and both tubes in the tuner *under* the chassis, so that the chassis had to be removed from the cabinet to gain access to them. They are getting some stiff competition, however, from the designers of some of the new sets and almost lost the cup last year to the genius who mounted his tuner upside down, far up in the front of the cabinet, with the tubes hanging downward, accessible only through a very small square hole in the vertical chassis. He lost out at the last moment due to lack of co-ordination with his associates; someone carelessly mounted the tuner with only two small screws, so that it could be removed bodily and pulled out of the chassis, giving easy access to the tubes! (It is generally believed that next year this oversight will be remedied by riveting the tuner firmly to the chassis!)

This divertissement out of the way, we remain with the problem of locating the unknown dead tube! Some devices have been brought out in recent years which are very helpful. Chief among these is a wee "Black Box" provided with tube sockets to match each type used in the set: 7-pin and 9-pin miniatures, octal *etc.* On the end, a c.r.t. receptacle is provided. Inside, a small battery and pilot lamp are wired up to the heater terminals of each valve-holder so that the lamp glows when a good tube, or one at least having a reasonable degree of continuity, is inserted in the holder. An a.c.-powered version includes a socket into which the cheater cord† is plugged, and a small neon lamp with series limiting resistor, to give the same results.

Some thoughtful makers are pasting a "heater-string layout" on the back of the cabinet or chassis. This shows a sketch of the chassis, with each tube indicated, and connecting lines showing just which tube is connected to what, *etc.* This is absolutely invaluable; by removing a tube in the centre of the string and measuring to each side of the line-plug with an ohmmeter, the dead half of the string may be located. Further tests will narrow the number of suspects down until the culprit is found. One bewildered technician removed a tube, and took the measurements mentioned; much to his surprise each half showed continuity. Upon replacing the tube, the set still refused to light up. Repeating the tests gave the same result. After a little while, it dawned upon him that he had removed the dead tube (dammit) on the first try, and was holding it while he measured the resistance of the remaining perfectly good tubes. The next day, he encountered seemingly the same situation. "Ah-ha!" he cried, checking the tube he had pulled out. To his chagrin, it was also good. Some little time later he discovered that the maker had thoughtfully included an autotransformer in the design, so that he had continuity back to the line, no matter which side of the string he measured! He finally located the extinct unit by the old method of testing each one in turn. (What? Certainly it was the last one he tested! What did you expect?)

Aside from the difficulties of locating dead tubes, another utterly charming feature of the series-heater sets lies in the inability of the technician to disable easily any given stage, by pulling the tube. For instance, if the local oscillator is to be disabled while aligning a set, a duplicate tube with its anode pin clipped off must be inserted in the socket, to make up continuity for the heater string. To follow this procedure for the whole set would imply the destruction of a complete set of good tubes. Of course, the next set coming along would have different types, so there goes another set of perfectly good tubes!

Actually, although the writer may sound rather acidulous about the whole thing, and the schematic of the set may look as if someone had dipped a very active inchworm (measuring-worm?) in the inkpot and released it on the page, these little sets are marvellously efficient, and not *too* difficult to service. (With exceptions, of course.) In fact, we have grown rather used to the contrary little monsters, and don't mind them so much. With the proper techniques and equipment, one will, in time, become able to check them out almost as fast as the older types. The points about the shock-hazard still remain, however, and must be watched very carefully. All in all, it is rather like the old story about the man who hit himself on the head with a hammer, because it felt so good when he stopped! We rather enjoy it, because it feels so good when we stop. Cheers.

† Cheater-cord—a cable and fittings used to bypass the devices disconnecting the a.c. mains supply on removal of the receiver back.—ED.

Manufacturers' Products

Decorative Television Masks

A NEW development in the production of decorative surrounds for television tubes is announced by Iridon, Ltd., 1, Avery Row, Grosvenor Street, London, W.1. High-impact polystyrene is used and the printed pattern providing the decorative effect is sunk below the surface of the plastic in such a way that it is completely protected and cannot be scratched, chipped or marred by abrasion. Designs at present available include mambo, blue fleck, filigree, pebbledash and woodgrain.

New Unspillable Accumulator

A RECENT addition to the Exide range of 6-volt accumulators for use in portable radio and electronic equipment is the Model 3EN5 known as the Silver Exide and weighing only 3½lb. It is completely unspillable in any position and is contained in a moulded translucent high-impact polystyrene case which is capable of withstanding mechanical abuse either in transit or in use. The level of the acid can be seen through the translucent case and maximum and minimum levels are indicated by two red lines seen in the illustration.

Terminals are cadmium plated and located as far as possible from the filling plugs and gas vents as a protection to corrosion. Intercell connections are made internally through the partitions, thereby reducing the path length and contributing to the low weight. Porvic and glass wool are used for separators.

The accumulator measures $3\frac{1}{16}$in × $3\frac{9}{16}$in × 5in high and has a capacity of 5 amp hr at the 20-hr rate of discharge.

The makers are Chloride Batteries, Ltd., Exide Works, Clifton Junction, Manchester.

Wide Band Attenuator

AN attenuation range from 0 to 61.5 dB in 0.5 dB steps at frequencies up to 60 Mc/s is available in the Wayne Kerr Q251 75-ohm π-section attenuator. Using the correction curves provided, the maximum error up to 20 Mc/s is 0.1 dB rising to 0.3 dB at 60 Mc/s. The zero-setting insertion loss is less than 0.05 dB up to 20 Mc/s, rising to 0.55 dB at 60 Mc/s. Power inputs up to one watt can be accepted. The attenuator costs £30, and is made by Wayne Kerr Laboratories, Ltd., Roebuck Road, Chessington, Surrey.

Multi-way Coaxial Switch

TO facilitate the rapid selection of v.h.f. transmitting or receiving aerials fed by coaxial cables without disturbing the nominal impedance of the system Racal Engineering, Ltd., Western Road, Bracknell, Berks, have introduced a 12-way rotary-type coaxial switch. It is ruggedly constructed from a cylindrical aluminium casting with 12 coaxial sockets around the periphery and one (inlet or outlet according to method of operation) placed at the back. A central rotor contacts each peripheral socket in succession. Stationary and moving contacts are made of rhodium-plated beryllium copper and mounted on polystyrene, the combination ensuring low-contact resistance, long life and low loss at high frequencies.

The switch can be motor operated as the torque is less than 3lb/in. Other features of the switch are:—working frequency up to 250Mc/s, impedance 52 ohms or as required by special order, 1kW power handling, adjacent contact isolation better than 80dB. The diameter of the switch is $4\frac{1}{16}$in, its depth is $4\frac{9}{16}$in and it weighs 2lb.

R.F. Power Meter

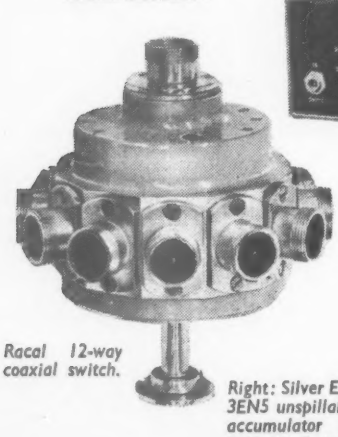
THE illustration shows a 500-watt r.f. power meter which is believed to be the first of its kind produced commercially in this country. It is the Type TF1205 and provides direct measurement of r.f. power from zero frequency to 500Mc/s.

It is an absorbtion-type instrument with oil-immersed heavy-duty, power-dissipative resistance element enclosed in a finned casing for heat dissipation by free air convection. Neither water nor forced air cooling is needed.

The power measuring equipment comprises a vacuum thermocouple fed from a tapping on the load resistor and a moving-coil meter mounted in a separate case which can be located up to 6ft from the power-dissipation unit. True mean power is measured irrespective of waveform.

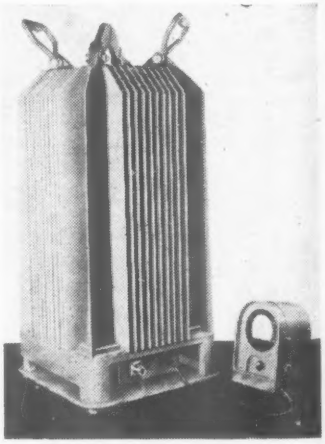
The makers are Marconi Instruments, Ltd., St. Albans, Hertfordshire.

Wayne Kerr 60 dB 75-ohm attenuator.



Racal 12-way coaxial switch.

Right: Silver Exide Type 3EN5 unspillable 6-volt accumulator in high-impact polystyrene case.



Marconi Instruments 500-watt r.f. power meter, Type TF1205.

APRIL MEETINGS

LONDON

9th. I.E.E.—Informal evening on "U.H.F. test transmissions" at 5.30 at Savoy Place, W.C.2.

10th. I.E.E.—"Radio observations on artificial satellites" by J. A. Ratcliffe at 5.30 at Savoy Place, W.C.2.

11th. Junior Institution of Engineers.—"Industrial applications in connection with television" by T. M. C. Lance (Cinema-Television) at 7.0 at Pepys House, 14 Rochester Row, S.W.1.

15th. I.E.E.—"A train performance computer" by Professor E. Bradshaw, M. Wagstaff and F. Cooke, "The simulation of distributed-parameter systems, with particular reference to process control problems" by J. F. Meredith and E. A. Freeman, and "A magnetic-drum store for analogue computing" by Dr. J. L. Douce and Dr. J. C. West at 5.30 at Savoy Place, W.C.2.

15th. Brit.I.R.E.—"Factors in the design of airborne doppler navigation equipment" by E. G. Walker at 6.30 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

16th. Society of Instrument Technology.—Annual general meeting followed by "Electronically operated power plant instrumentation and control" by R. E. J. Putman at 6.0 at Manson House, Portland Place, W.1.

17th. Armed Forces Communications and Electronics Association.—Visit to Wembley Studios of Associated Rediffusion.

18th. Television Society—"Transistors in television receivers" by B. Overton (Mullard) at 7.0 at the Cinematograph Exhibitors' Association, 164, Shaftesbury Avenue, W.C.2, (originally announced for March 13th.).

18th. B.S.R.A.—"Acoustics and loudspeakers" by R. A. Bull at 7.15 at the Royal Society of Arts, John Adam Street, Adelphi, W.C.2.

21st. British Computer Society.—"The use of an electronic computer in research statistics" by Dr. Frank Yates at 6.15 at York Hall, Caxton Hall, Westminster, S.W.1.

23rd. I.E.E.—"Survey of performance criteria and design considerations in high-quality monitoring loudspeakers" by D. E. L. Shorter at 5.30 at Savoy Place, W.C.2.

24th. Institution of Electronics.—"Radioastronomy and the sputniks" by Dr. F. G. Smith (Mullard Radioastronomy Observatory, Cambridge) at 7.0 in the Assembly Hall, The University of London Institute of Education, Malet Street, W.C.1.

25th. Institute of Navigation.—"The use of simulators for training navigators to use radar equipment" with contributions from the Navy, R.A.F. and Ministry of Transport and Civil Aviation at 5.15 at the Royal Geographical Society, 1 Kensington Gore, S.W.7.

28th. I.E.E.—"Economic usage of broad-band transmission systems" by R. J. Halsey at 5.30 at Savoy Place, W.C.2.

30th. British Kinematograph Society.—"An instantaneous electronic colour film analyser" by the Hazeltine Research Corp. and Pathe Laboratories Inc. at 7.15 at the Royal Society of Arts, John Adam Street, Adelphi, W.C.2.

CAMBRIDGE

22nd. I.E.E.—"Underwater television" by D. Allanson at 8.0 at the Cavendish Laboratory, Free School Lane.

CHELMSFORD

15th. I.E.E. Graduate and Student Section.—"The principles of electronic keyboard instruments" by B. Basham at 7.0 in the Public Library.

CHELTENHAM

25th. Brit.I.R.E.—"The automatic factory" by J. A. Sargrove at 7.0 at the North Gloucestershire Technical College.

EDINBURGH

7th. I.E.E.—"Broad-band slot-coupled microstrip directional couplers," "Re-entrant transmission line filter using printed conductors" and "The application of printed-circuit techniques to the design of microwave components" by J. M. C. Dukes at 7.0 at the Carlton Hotel, North Bridge.

LUTON

8th. I.E.E. Graduate and Student Section.—"Transistor amplifier circuits" by W. A. Thorpe at 7.0 in the Staff Canteen of D. Napier and Son, The Airport.

MALVERN

14th. I.E.E.—"Developments in semi-conductors" by E. G. James at 7.30 at the Winter Gardens

29th. Institute of Physics.—One-day symposium on "Some applications of solid state physics in computers and automation" in the Priory Lodge Hall, Winter Gardens.

MIDDLESBROUGH

2nd. I.E.E.—"Some transistor input stages for high-gain chopper-type d.c. amplifiers" by Dr. G. B. B. Chaplin, and A. R. Owens at 6.30 at the Cleveland Scientific and Technical Institute, Corporation Road.

NEWCASTLE

16th. Society of Instrument Technology.—"Fundamentals of electronics as applied to instruments" by A. L. Anderson at 7.0 in the King's College, Stephenson Building.

PORTSMOUTH

2nd. I.E.E.—"Junction transistors" by E. Wolfendale at 6.30 at the C.E.G.B. Offices.

STONE

14th. I.E.E. and Institution of P.O. Electrical Engineers.—"The importance of research in hearing and seeing to the future of telecommunication engineering" by Dr. E. C. Cherry at 7.0 at the Duncan Hall.

YORK

1st. I.E.E.—"The control and instrumentation of a nuclear reactor" by A. B. Gillespie at 7.0 at the Royal Station Hotel.

LATE-MARCH MEETING

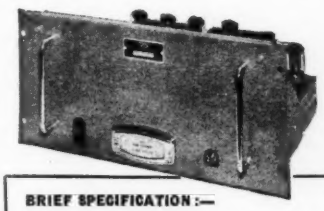
28th. Institution of Production Engineers.—"The electronic control of machine tools" by D. T. N. Williamson (Ferranti) at 7.30 at the Technical College, Abbey Road, Barrow-in-Furness.

TRIX

60 watt AMPLIFIER

The power amplifier T664, illustrated below, has been developed to meet the need for a unit of relatively high output to be used in larger Sound installations. The T664 is primarily designed for mounting in our rack assemblies and has duplicated plug-and-socket facilities for inter-connecting a multiplicity of amplifiers.

It can also be made available as a self-contained unit, if required, with ventilated cover. The necessary mixers and pre-amplifiers can be chosen from our range according to requirements.



BRIEF SPECIFICATION:—

POWER OUTPUT
63 watts with total harmonic distortion not exceeding 1%.
73 watts with total harmonic distortion not exceeding 5%.

FREQUENCY RESPONSE
50–20,000 cps within ±1 db.

OUTPUT STAGE
Four EL34 valves in parallel push-pull.

INPUT SENSITIVITY
0.85v. Resistance 470K ohms.

OUTPUT IMPEDANCE
165 ohms for 100 v. line matching.

FEEDBACK
16 db.

HUM and NOISE LEVEL
Below −65 db.

HT/LT SUPPLY
300 v. 30 mA., 6.3 v. 2 amp.

Please write for full details of our complete range of Sound Reproducing Equipment

TRIX ELECTRICAL COMPANY LTD.
1-5 Maple Place, Tottenham Court Road London, W.1
Tel: MUSeum 5817 Grams: Trixadio Wesdo London

P824

RANDOM RADIATIONS

By "DIALLIST"

V.H.F. Going Strong

THOUGH I haven't seen latest figures for the number of v.h.f. sound or television-cum-sound receivers in use, it must by now have reached a pretty big total, if the number of one's friends who have one or the other is anything to go by. I hardly ever go to a house in my district nowadays without finding v.h.f. installed and hearing its praises sung. The musical are delighted with the quality of reproduction obtainable and even the non-musical are loud in their praises on account of the freedom from interference that it gives. Interference with long-wave and medium-wave broadcasting is rather serious if you live on or near the more southerly parts of the East Coast. It's not an overstatement, in fact, to say that a concert or a play is seldom worth listening to on the a.m. bands. But with f.m. on Band II reception is normally as good and as clear as one could wish. There are, though, folk who don't give their f.m. receivers a chance. One friend who had gone in for a quite expensive set told me that it wasn't any good at all and that he was deafened by motor ignition interference. On going round to investigate I found that he was running the set in a ground-floor room, with a ramshackle aerial made of flex fixed to the picture rail! I can't think why people do such silly things; but do them they just will! Band II aerials don't cost much and they're too small (and usually too simple) to be unsightly. In that particular case a single dipole with a coaxial feeder made all the difference, and interference became a thing of the past.

TV Whistle

BY THE purest of coincidences (for they didn't know that I was writing the paragraph and I didn't know they'd written to the Editor on the subject) my note on TV whistle appeared in the same issue of *W.W.* as a letter from Peto Scott showing that their television receivers were whistle-free. I suggested, if you remember, that there were ways of obtaining e.h.t. voltage which wouldn't give rise to this nuisance. One reader took me to task, saying that he didn't believe that the whistle could be entirely eliminated. Well, Peto Scott have managed it and others should do likewise. Their letter shows that the whistle comes from the joins of the two halves of the core of a conventional auto transformer which, unless they are completely rigid, are bound to make slight movements under the magnetic effect of the alternating flux. The repetition frequency of the line scan being 10,125 c/s that gives you that infernal whistle. One of the consolations for having lost some of your h.f. hearing response is that the wretched noise becomes inaudible, or very nearly so. The fact that it is produced strongly by so many of our TV receivers is a real blot on their escutcheon and one that designers and manufacturers should take steps to remove.

Spot-Wobble, or Spot-Astigmatism?

IT'S a good many years since I first saw spot-wobble demonstrated on a 21-inch set specially made by Cintel for the B.B.C. Its possibilities made a great impression on me and I felt sure that it would be the coming thing in big-screen TV. Somehow, it doesn't seem to have caught on as one expected it to and I still don't quite know why. Its use certainly softens the picture a little and very slightly reduces the definition. But one would have thought that those things were a small price to pay for a big picture which can be viewed at quite close range owing to the absence of lininess. The demand for large sets is a growing one, even though it can't always be easy to sit far enough from the screen and near enough to the fire in the smallish living rooms of today. I wonder whether spot-astigmatism (or spot-elongation, as it's sometimes called) would furnish a more acceptable solution. Or, do some people perhaps like lininess?

Rules of Thumb

IF used with discretion rules of thumb can be most useful things. They save time by enabling you to get approximate answers to a good few radio problems in a twinkling and many of them are surprisingly accurate. One that most people know nowadays concerns the minimum eye-to-screen distance for TV viewing, if lininess is to be avoided: divide the inches of the screen's diameter (or diagonal) by two and that gives you the distance in feet. What's the maximum picture width obtainable on a screen of given size? It's five-sixths of the diameter or diagonal. There's rather a good one for frame aerials: irrespective (within reason, of course!) of size or shape you need 75 feet of wire for the medium and 250 feet for the long waves. For the quick conversion of

ASSOCIATED ILIFFE TECHNICAL BOOKS

"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
LOW-COST HIGH-QUALITY AMPLIFIER. P. J. Baxandall, B.Sc.(Eng.)	3/6	4/-
INTRODUCTION TO VALVES. R. W. Hallows, M.A.(Cantab.) and H. K. Milward, B.Sc.(Lond.), A.M.I.E.E.	8/6	9/4
ABACS OR NOMOGRAMS. A. Giet. Translated from the French by H. D. Phippen and J. W. Head	35/-	36/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 4th Edition	30/-	31/9
TRANSISTOR A.F. AMPLIFIERS. D. D. Jones, M.Sc., D.I.C., and R. A. Hilbourne, B.Sc.	21/-	21/10
SECOND THOUGHTS ON RADIO THEORY. "Cathode Ray" of *Wireless World*	25/-	26/4
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/9
BASIC MATHEMATICS FOR RADIO AND ELECTRONICS. F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. Revised and enlarged by J. W. Head, M.A.(Cantab.). 3rd Edition	17/6	18/6
PORTABLE TRANSISTOR RECEIVER. S. W. Amos, B.Sc.(Hons.), A.M.I.E.E.	2/6	2/10

A complete list of books is available on application

Obtainable from all leading booksellers or from

ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1

yards into metres and *vice versa*, a metre roughly equals a yard plus 10 per cent, and a yard, a metre minus 10 per cent. A yard a second is two miles an hour. That one is pretty close, for there are 3,600 seconds in an hour and 3,520 yards in two miles. Do you know the one about the impedance of moving-coil loudspeakers? $Z \approx 1.5$ R (d.c.). And dust-cored coils: with the core at the mid position, L is about $\frac{1}{3}$ greater than that of an equivalent air-cored coil. I'm sure that readers know lots more good rules of thumb and I'll be most grateful for any you care to send in.

Safety First

AN article in a recent issue of the *I.E.E. Journal* stressed the importance of safety first with electricity. There is, however, one most undesirable though very widespread practice to which reference wasn't made. That's the use of 2-pin plugs and sockets, or lampholders with adaptors, for the connection to the mains of all manner of domestic appliances. Since the 2-pin plug or the 2-point adaptor will go in with equal ease either way round it's a pure toss-up whether or not you make those parts of the apparatus live which should not be so. Wrong connections are responsible for many accidents (and a much greater number of narrow shaves) with apparatus such as electric irons and sewing machines, to say nothing of mains-operated sound and television sets. I'd like to see the 3-pin plug and socket made compulsory. Using it, things are straightforward enough with a.c. But with d.c. there's an additional precaution needed. In some d.c. systems the positive is earthed; in others the negative; so one must make sure that all sockets are correctly wired up.

Stereo-sound

STEREOPHONIC sound and stereoscopic vision are rather mouthfuls; so why shouldn't we prune them down to stereo-sound or stereo-vision? I know that they are mongrel words; but so are many other scientific terms and anyhow neither is offensive to eye or ear. The B.B.C.'s recent experimental transmissions gave some idea of the realism sound broadcasting can provide. I hope that there'll be many more of these transmissions and that wide use will be made of two channels of a number of v.h.f. stations. That would enable pairs of owners of v.h.f. receivers to co-operate in stereo-sound reception.

Miniature
Toggle Switches
BULGIN
ENGLAND
S258PDO
...the best in the world!
The largest range of Miniature Snap-action Toggle Switches made; lever, rotary or press operated. Millions in continuous use, everywhere. Full details of hundreds of types in one complete Catalogue, No. 198/WW. (Free to trade letterhead or order.
THE HOUSE OF
BULGIN components
A. F. BULGIN & CO LTD., BARKING, ESSEX.
Telephone: RIPpleway 5588 (8 lines)
MANUFACTURERS OF RADIO AND ELECTRONIC COMPONENTS

UNBIASED

By FREE GRID

Super-Stereophony

IT IS strange how our boyhood interests remain the same but grow more spiritualized as we approach manhood. Thus every schoolboy is familiar with the vital statistics of a locomotive, and if a friend enthuses to him about a 4-4-2 tank engine he will at once have as clear a mental picture of it as he will of a 34-24-36 blonde about whom his friend may show equal enthusiasm in later years.

In other words his interest in vital statistics has shifted from a material and soulless plane up to a spiritual and soulful one. Late in life interest reverts to tank engines and that is why this period of existence—for can it be called life?—is known as second childhood.

I have found myself taking such an unhealthy interest in railway engines of late that I should feel really worried were it not for the fact that I still feel as strongly as ever the manhood desire to be the conductor of a great orchestra with no sign of a reversion to the original boyhood desire to be a bus conductor.

As a matter of fact I feel so strongly the desire to be an orchestral conductor that I have worked out a technical scheme whereby I can achieve my ambition without forcing Sir Malcolm Sargent into the bread line. My scheme is to provide a separate mike, amplifier and recorder (disc or tape) for every member of an orchestra. Thus there would be a separate recording of every instrument in the orchestra.

At home I should have a completely separate reproducing chain for each record, and the individual loudspeakers would be placed in the same positions as those occupied by the various instruments in the original orchestra. Each of the many separate amplifiers would have a bass boost and treble turn-up control, these all being mounted in a desk control panel situated in the same place as the conductor normally occupies.

I should therefore be able to call forth the same response from each section of the orchestra—or even from each instrument in any section—as a normal conductor can. This could have two effects. In the first place it would enable me to satisfy my ambition to be an orchestral conductor and secondly it would provide my family and friends with the same effect as though they were sitting in the Festival Hall; well, perhaps that is exaggerating a little but it would indeed provide super-stereophony.

I am fully aware of the many snags such, for instance, as the fact that my recording would bear the impress of the original conductor who presides over the orchestra at the recording session. All the same I have hopes that my one-man band will appear at the Festival Hall eventually.

My one-man band

11+ And 11×

MOMENTARY mental aberration is likely to affect all of us at times and I am grateful to Dr. Humphrey Denham for pointing out in the March issue that the e.m.f. of the Clark cell is 1.433 volts and not 1.1 so that it cannot be the basis of the fact that a multiple of 11 is used in power supply voltages. This 11× business would have ploughed me in my 11+ exam had I ever taken it.

However, I don't think that any of the other suggestions that have been put forward to explain this 11× business is the correct one. I think I have worked out the correct explanation all by myself. For what it is worth, it is as follows.

In the early days of electric lighting the only people able to enjoy the new invention were those wealthy enough to install private plants. These private installations came long before any attempt at town lighting. Very naturally such plants consisted of a battery of secondary cells and a d.c. generator to charge them. It was, of course, possible to install a generator alone but the steam engine which drove it needed stoking, and it was normal to install storage cells so that the power house could be shut down and left unattended at night time.

Obviously, therefore, the voltage of the generator had to be chosen according to the number of cells it was intended to charge. Now it so happens that the open-circuit voltage of a lead-acid cell is 2.2 and so it at once becomes obvious how the 11× complex arose. Installations were to be had with as many as 50 cells giving 110 volts. This quickly fell to 100 volts on load, and lamps of this voltage were used. But 25-cell plant was to be had and also installations using an even smaller number of cells and these were actually far more common than the plutocratic 110-volt type.

Query Corner

I OFTEN find odd gaps in my knowledge of radio and electronics which I don't seem to be able to fill by dipping into standard textbooks. Maybe you have some odd gaps too and we can get together and remedy each other's deficiencies. Here are two of my gaps for a start.

I have never been able to find out why the letter I is used as the symbol for current. The other two symbols in Ohm's law are obvious but not so I. Was it because C was already in use, and the letter I happened to be the next vacant letter available or is it the initial letter of some foreign word meaning flow. To me, it is a bit of a mystery like the use of X to denote an unknown quantity.

My next query used to worry me over thirty years ago when we all used secondary cells as our source of l.t. Now that car radio has brought back secondary cells as the prime source of both our l.t. and h.t. supplies I am worried once again. My query is simply this! Why do all lead-acid accumulator manufacturers warn us to be careful to remove the vents before connecting up to a trickle charger?

Before you all write to tell me that if this were not done the "gassing" due to the 2-amp trickle charging current, would buckle the plates and casing or something like that, let me remind you that we often bowl along on a summer day passing 10 amps through our long-suffering accumulator long after it is charged.

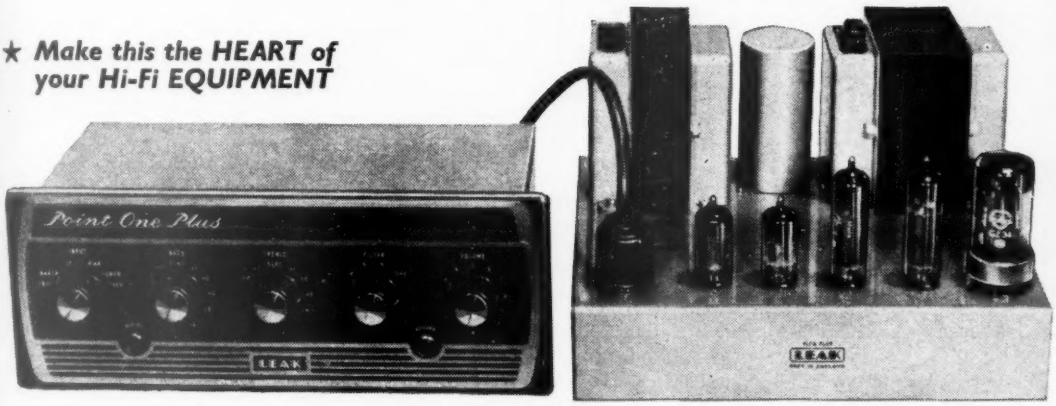
I have tried to get enlightenment on this point at the stands of all the leading accumulator makers—chiefly at the Motor Show, of course. I have always met with suave politeness and an indulgent smile as the young men on the stands try to blind me with science and intimate that my technical knowledge is not up to the necessary standard to enable me to understand why 10 amps on the move is less lethal than 2 amps in the garage.

I'm sure one of you know the correct answer.

NEW

by LEAK "Point One Plus" Pre-amplifier & TL/12 Plus Power Amplifier

★ *Make this the HEART of your Hi-Fi EQUIPMENT*



The "Point One Plus" pre-amplifier is Styled by the world-famous designers RICHARD LONSDALE-HANDS ASSOCIATES

The "Point One Plus" pre-amplifier and TL/12 PLUS amplifier when used with the best available complementary equipment give to the music-lover a quality of reproduction unsurpassed by any equipment at any price. Even when the complementary equipment falls below that of the best obtainable, the use of these amplifiers will enable one to obtain very marked improvements in reproduction.

LEAK amplifiers have been the choice of the B.B.C. (over 500 delivered), the South African Broadcasting Corporation (600), ITV and many other Commonwealth and overseas broadcasting and TV systems, who use them for transmitting and/or monitoring (quality checking) the broadcasts to which you listen. Also, many of the gramophone records you buy are cut via LEAK amplifiers. This acceptance by professional audio engineers has led to a demand for LEAK equipment from music-lovers throughout the world.

It is appropriate here to mention one of the basic principles of LEAK design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased costs incurred for high-grade materials, components and finishes, and this together with quantity production (made possible only by a world-wide market) explains how quality products may be sold at reasonable prices.

Designed by HAROLD J. LEAK to give OPTIMUM RESULTS from:—

- **Any pickup available in the world**
- **Any radio tuner available in the world**
- **Any tape recorder/reproducer available in the world**
- **Any dynamic microphone available in the world**

30 GNS *complete*

A price made possible only by WORLD-WIDE SALES

The new "Point One Plus" and TL/12 Plus were exhibited and demonstrated at the New York Audio Fair and received enthusiastic consumer acceptance resulting in initial orders for one thousand one hundred and fifty sets.

LEAK *The First Name in High Fidelity*

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, LONDON, W.3, ENGLAND.

Telegrams: Sinusoidal, Ealux, London
Telephone: SHEpherds Bush 1173/4/5 Cables: Sinusoidal, London

Please send details of

☐ *FM Tuner*
☐ *Gram. Pickup*
☐ *Amplifiers*

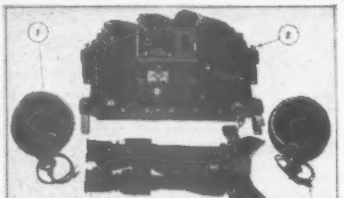
☐ *Please send name and address of my nearest Hi-Fi dealer*

Name .....

Address .....

.....

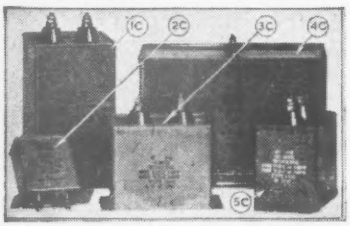
WW/4/58



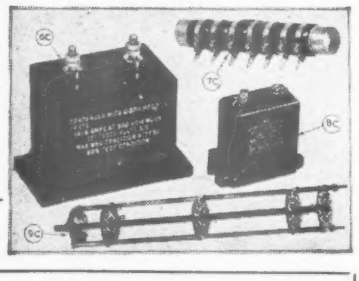
TABBY EQUIPMENT COMPLETE

Complete equipment for seeing in the dark, as fitted to Army vehicles for night driving, etc. Complete working equipment comprises: 2 Infra Red Radiators, adjustable binoculars, powerpack for 6 or 12 volts, control units and inter-connection cables. Original cost probably around £100. Unused and in perfect order— **£10**, plus 10/- carriage and insurance. Mains power pack £4 extra.

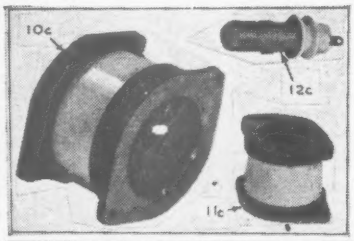
TELEPHONE REPEATER No. 1, Mark 1. This equipment is for amplifying telephone signals in both directions of traffic and also to remedy line distortion of speech. It is intended for use with two wire or four wire circuits, has four amplifiers and is in fact two quite independent repeaters mounted on the same panel and having a common power supply. The power supply may be operated from a 12-volt car battery or from standard A.C. mains. The units are absolutely new in original packing complete with spares and instructional manual. Price **£20** each.



1C—MANSBRIDGE (PAPER) CONDENSER. .5 mfd rated at 4,000 v., but safe for much higher voltage; Size approx. 5in. × 3in. × 3in., **15/-**. 2C—2 mfd 500 v., size 2½in. × 2in. × 1½in., **2/6**. 3C—.1 mfd 3,000 v working, size., 3in. × 3½in. × 2½in., **10/-** 4C—80 mfd. 300 v., size 4½in. × 7in. × 3½in., **5/-** 5C—.25 mfd. 2,500 v., size 3in. × 3½in. × 2½in., **7/6**



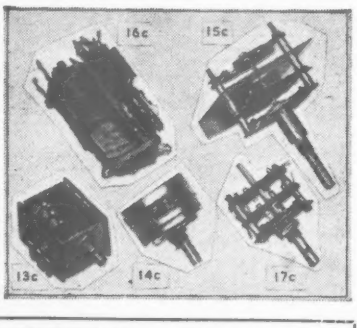
6C—MICA CONDENSER. .0011 mfd. 28,000 v., size 3½in. × 3½in. × 2½in., **15/-** each.
7C—100 w. RESISTOR. Total 6,000 ohm tapped at 1,000, 2,000, 3,000, 4,000 and 5,000 ohms, **8/6** each.
8C—ELECTROLYTIC CONDENSER. 150 mfd. 25 v., size 2½in. × 2½in. × 1½in., **2/6**.
9C—YAXLEY SWITCH. Extra long pattern, easily comes to pieces for rebuilding. Length approx. 15in. Price **3/6**.



10C—TRANSMITTING CONDENSER. Type No. 1970/800, American made (Aerovox) .0012 mfd., 20,000 v., size 5in. diameter 4in. high, **24/15/-**. 11C—.002 mfd., size 3½in. diameter 2½in. high, **25/-** each.

12C—TRANSMITTER CONDENSER. Type W3772, .001 mfd., 9,600 v., **15/-** each.

13C—6 POLE "ON"—"OFF," or 3 pole changeover switch, size approx. 2in. × 1½in. × 1½in., plus spindle, **2/6** each.
14C—WIRE WOUND POT METER. 2,000 ohm, 10 w. diameter aporox. 1¾in., depth approx. 1½in., **5/6** each.
15C—YAXLEY SWITCH. 6 pole 2 way 2 banks with intermediate screen, **3/6** each.
16C—POST OFFICE RELAY. Slow closing type (1½ slug), 150 ohm coil contacts—4 break 2 make, **10/-** each.
16C/1—POST OFFICE RELAY. As above, but delayed closing (3½in. slug) coil resistance 2,000 ohm, contacts 2 make 1 break, **12/6**.



17C—YAXLEY SWITCH. Double space 4 pole 4 way, **2/6**.

18C—3 PIN MAINS INPUT SOCKET. Ref. No. ZA5585, **2/6** each.

19C—HIGH TO LOW IMPEDANCE HEADPHONE ADAPTOR. Ref. No. MC383C, simple wiring change makes this low and high impedance, contains potted transformer, **4/6**.

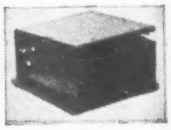
20C—BELLING LEE FULLY INSULATED TERMINALS. For mounting through metal panels, **2/-** each.

MOTORISED GEAR PUMP

Will build up tremendous pressure for operating hydraulic rams, lifts and similar equipment. Geared to 24-volt D.C. motor, but this can be operated off A.C. mains through step down transformer. **£17/10/-** each.

TEAK AND PLYWOOD INSTRUMENT BOX

Hinged lid, metal inserted screws. Internal dimensions 10in. × 11in. × 5½in. deep. **8/6**, plus 2/6 post and packing.



MAINS TRANSFORMER

400-0-400 volt at 100 mA., two 5 volt 2 amp. heating windings, electrostatic screen and primary for 220-240 v.. 50 C.P.S. mains, **27/6**, plus 2/6 post.

3 PHASE HEATER CABLE

3 core 7.029 heavy P.V.C. insulated. Cores coloured red, blue and white. Outer covering of braiding compounded. Suitable for 3 phase or power extensions. **75/-** per coil of 100 yds. Carriage 3/6.

SUB-MINIATURE ELECTROLYTICS

These are extremely small—for instance, .1 mfd. is only approx. ¼in. long by a little over ¼in. diameter. Mainly developed for transistor receivers, price **2/9** each. Special quotes for quantities. The following values available but additional types are being added almost weekly. 1 mfd. 18 v., 1½ mfd. 6 v., 2.5 mfd. 6 v., 6 mfd. 6 v., 5 mfd. 12½ v., 8 mfd. 6 v., 10 mfd. 6v.

MOTORISED ROTARY SWITCHES

Ministry Ref. No. AP57579, this is a motor-driven switch, the driving motor being a synchronous type for working on 110 volts 50 cycles. The two switches have 20 positions each and are enclosed by a Perspex fronted lid, separately operated relays providing interlocks. Sale price **27/6** each. Carr. 3/6.

EX-GOVERNMENT VALVES

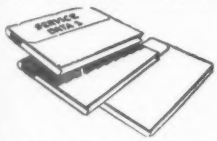
Many types in stock. Here are some of the more popular ones:

1T4	7/6	6K8	9/6	954	3/6
1LD5 ..	3/6	6L6	9/-	1625 ..	10/6
2X2	4/6	6N7	7/6	DDT4 ..	8/6
3A4	7/-	6SA7 ..	8/-	DDT13 ..	8/6
5Z4	9/6	6Q7	9/6	DH73 ..	9/6
5U4	8/-	6SJ7	9/6	DL74 ..	9/6
6AC7 ..	6/6	6SK7 ..	6/-	EF80 ..	8/6
6AL5 ..	0/6	6SL7 ..	3/-	EL50 ..	10/6
6B8	4/-	6V6	9/6	H63 ..	6/6
6C4	6/6	7A7	9/6	HL4G ..	9/6
6C6	6/6	7V7	9/6	HL13 ..	9/6
6D6	6/6	7Y4	8/6	HL1320	9/6
6F6	7/6	25Z4	9/6	KT61 ..	9/6
6F8	9/6	25Z6 ..	10/6	KT72 ..	9/6
6G6G	4/6	25Y5 ..	10/-	KTW61	4/6
6H6	2/6	42	8/-	KTW73	9/6
6J5	5/-	43	10/-	KTZ41	9/6
6J7	6/-	75	12/6	U12	8/6
6K6	7/-	77	8/6	U74	9/6
6K7	7/6	78	8/6	U71	9/6
		84	8/6		

Band III Converter

Suitable Wales, London, Midlands, North Scotland etc. All the parts including 2 EF80 valves coils, fine tuner, contrast control, condensers, and resistors. (Metal case available as an extra.) Price only **19/6**, plus 2/6 post and insurance. Data free with parts or available separately **1/6**.

T.V. SERVICE SHEETS



100 sheets covering the most popular post-war Televisors by leading makers —Cossor, Ekco, Ferguson, Pye, etc., etc. Give circuit diagram component values, I.F. frequencies, etc., **£1** post free.

DON'T BE CAUGHT LIKE THIS

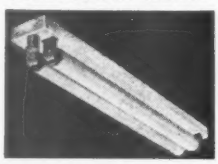
CAR STARTER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following.

Mains transformer	22/6
5-amp. rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	2/6
0-5 amp. Moving Coil Meter	12/6
Construction Data	1/6
or if bought all together price is	52/6

plus 3/6 post and packing.

FLUORESCENT LIGHTS



These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations.

Single 99. 4ft. 8in. long, uses a 40 watt tube.

Twin 20. Uses two 20-watt standard tubes. Price **39/6** each, with tubes.

Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

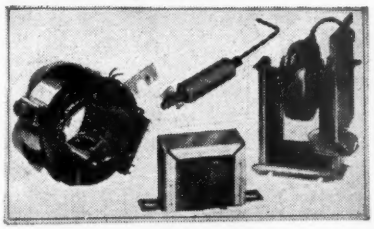
Yaxley Switches

3-pole, 2-way	1/3
12-pole, 2-way	1/6
3-pole, 3-way	1/6
9-pole, 3-way	2/-
2-pole, 4-way	2/-
6-pole, 4-way	2/6
4-pole, 5-way	2/6
2-pole, 6-way	2/6
1-pole, 7-way	2/6
1-pole, 12-way	2/6
6-position shorting switch	2/-
Double pole mains switch for attaching to Yaxley switches	1/6

Discount of 10% allowed where a dozen of one type ordered.

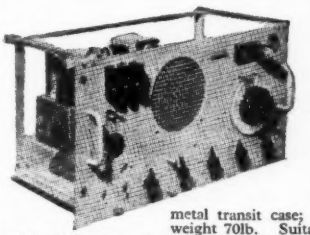
Special quotes 144 or over.

Four items for the price of one



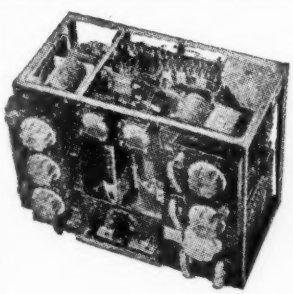
This set of modern T.V. parts is equally suitable for modernising an old televisor or for building into a new one. Suitable for wide angle 14in. or 17in. tubes using E.H.T. or 12-14 K.V. The four items comprise: (1) line output E.H.T. transformer; (2) 70° scanning coils on ferrite yokes; (3) width control with ferrite core; (4) frame output transformer. With these parts we also give free, complete circuit diagram of modern televisor which uses them. We offer the whole lot at the price of the line output transformer only, namely 57/6 plus 2/6 post and insurance.

Short Wave Communications Receiver R208



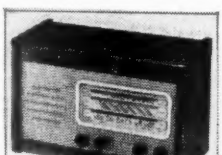
This is a super short wave receiver covering 5-30 metres (10-60 mc/s) Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 × 18 × 12; weight 70lb. Suitable A.C. mains, 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price £6/19/6, carriage and insurance 15/-.

Famous Transmitter Virtually Given Away



The famous R1154N —unused but slightly soiled and not tested. Covers 200-500 Kc/s., 3-5.5 mc/s and 5.5-10 mc/s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley oscillator, power amplifier, keying and speech. Wonderful breakdown value meters, relays, switches. Complete with valves—real bargain at 29/6, plus 10/- carriage.

Cabinet with Chassis Bargain



is a fine walnut veneered table receiver cabinet complete with metal chassis, three colour glass scale, back plate and scale mounts, as illustrated but less knobs. Offered at less than the price of the cabinet namely 39/6 plus 5/- carriage and insurance.

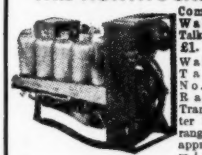
NOW TWO MODELS TURRET TUNER

Brand new stock, not surplus, with coils for Band I and III, complete with valves. Model I.—I.F. output 33/38 mc/s. Series heaters. Model II.—I.F. output 16-19 mc/s. Parallel heaters with, circuit diagram **79/6**. With knobs 3/6 extra, post and ins. 2/6.

HI-FI SNIP Infinite Wall Baffle

Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low priced 8in. speaker. Fitting for tweeter. Only **45/-** each, carriage and insurance 3/6.

THIS MONTH'S SNIP



Complete Walkie-Talkie for £1. Walkie-Talkie No. 38 Radio Transmitter has a range of approx. 5 miles. Just right for search parties, fire brigades, etc. operates on dry batteries. Complete with five valves and in metal case. Size approx. 9 × 6 × 3½in. Unused but not tested or guaranteed. **£1** only, plus 2/6 post and insurance.

Tube Tester and Re-Activator

We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will re-activate them, supplied complete with full instructions. Price **£3**, plus 2/6 post and ins.

Two New Kits

R. & C. SUBSTITUTION BOX

As described in March "Practical Wireless" Author describes this as second most used instrument on his bench. Kit of components with full instructions **£2/10/-** plus 2/6 post and ins.

Simple Tone electronic organ described in February issue. Kit of components as specified complete with valves but not chassis or case. **£4/10/-** plus 3/6 post and ins.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 2.

42-46, Windmill Hill, Ruislip, Middx.
Phone: RUISLIP 5780
Half day Wednesday.

66, Grove Road, Eastbourne, Sussex.
Half day, Saturday.

29, Stroud Green Rd., Finsbury Park. N.4.
PHONE: ARChway 1049
Half day, Thursday.

266, London Road, Croydon.
Phone: CRO 6558.
Half day, Wednesday.

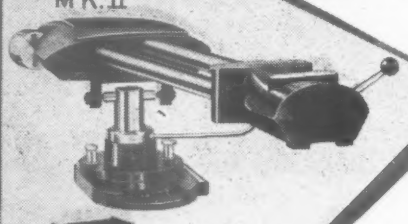
THE WORLD'S FINEST HI-FI PRODUCTS

Visit us at the
LONDON AUDIO FAIR
ROOM 130 and
STAND 44

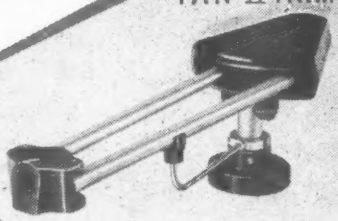
BJ

Write for leaflets and see your dealer NOW

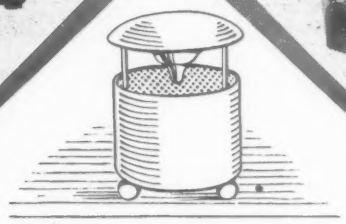
'SUPER 90' MK.II

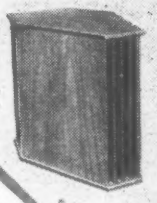


TAN II ARM



R1





R2

R1
Fit your own 12in., 10in. or 8in. loudspeakers in this Reproducer. Improved realism is guaranteed.

TOP "C" TWEETER
Sensational new tweeter stands on top of any reproducer adding a smooth frequency response up to 18,000 c/s. It also complements the new BJ R.2. The Top "C" is complete with built-in crossover and balance control.

R2
The new horn loaded and reflex reproducer is complete with professional 12in. loudspeaker. Smooth frequency response from 25-9,000 c/s.

BURNE-JONES & CO. LTD. • CHEAM • SURREY • ENGLAND

ELECTRONIC TECHNICAL SERVICES

TELEPHONE – RAVENSBOURNE 8951-2

Contractors to

Ministry of Supply

Admiralty

Atomic Energy Authority

Specialists in the preparation of TECHNICAL HANDBOOKS

EMERGENCY
Drawing Office Services

1 NEWMAN ROAD
BROMLEY KENT

We are exhibiting at
STAND 93
R.E.C.M.F.
and **STAND 313**
I. E. & A. Exhibition

Improved cable clamps on the new range of our Miniature Hermetically Sealed Co-axial Plugs and Sockets will withstand a pull of up to 35 lbs., and are suitable for use with Uniradio 70 cable.

They have been developed and Type Approved to Inter-Service Requirement under R.C.S. 322 and are freely interchangeable with the types which they supersede.

The new types are hermetically sealed and 100% production tested. Sealing caps are available for uncoupled units.

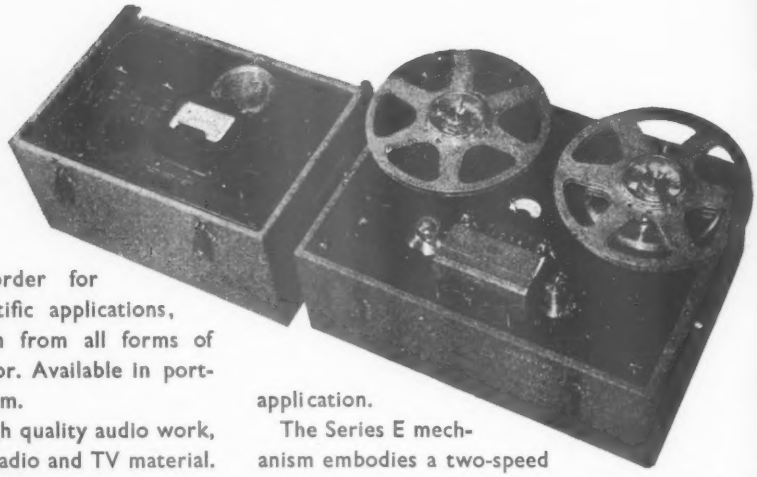
MAGNETIC DEVICES LIMITED

MAGNETIC DEVICES LIMITED
A. I. D. & A. R. B.—Approved
Exning Road, Newmarket, Suffolk
Phone: Newmarket 3181/2/3. Grams: Magnetic Newmarket.

MD 23A

LEEVERS RICH

MAGNETIC TAPE RECORDER SERIES E



An A.C. operated heavy-duty magnetic tape recorder for studio, industrial and scientific applications, where the utmost freedom from all forms of signal distortion is called for. Available in portable or rack-mounting form.

Standard models for high quality audio work, such as master recordings, radio and TV material. **Special versions** for such purposes as recording ultra-sonic phenomena, stereo recording, and multi-channel instrumentation. A plug-in amplifier system is available covering a wide field of application.

The Series E mechanism embodies a two-speed synchronous motor capstan drive as standard, but will accommodate alternative capstan units of the servo type, giving wide speed range or extreme accuracy of linear speed over long periods.

LEEVERS-RICH EQUIPMENT LTD.
78B Hampstead Road, London, N.W.1 EUSton 1481

Ardente make a wide range of

ELECTRONIC MINIATURE COMPONENTS

TRANSFORMERS
POTENTIOMETERS
EARPHONES
SOCKETS
SWITCHES

The miniature components with the big technical background

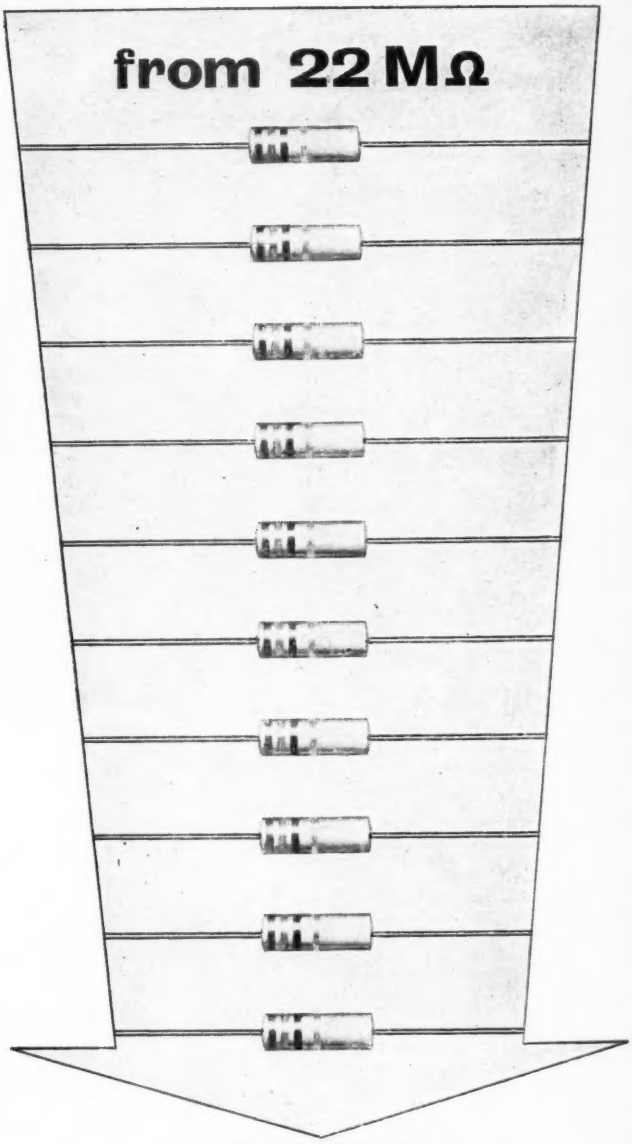
Sole Manufacturers and Exporters:
ARDENTE ACOUSTIC LABORATORIES LTD.
8-12 MINERVA ROAD, NORTH ACTON, LONDON, NW10 *Telephone: ELGar 3923*

Visit us at the R.E.C.M.F. Exhibition, **Stand No. 143** and at the Hanover Fair, **Stand No. 1329.**

Suppliers of components and hearing aids to the Government and manufacturers all over the world

getting down to it

from 22 MΩ



to 10 Ω

We are pleased to announce that our range of BTA (1W.) and BTS (½W.) resistors has been extended down to 10Ω. We can now supply these resistors from stock in the preferred values from 10Ω to 22MΩ.

Please write for full details.

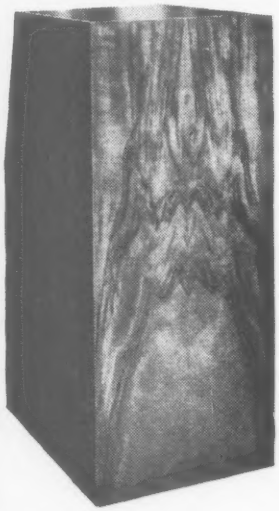
We shall be pleased to see you on our STAND 33 at the R.E.C.M.F. Exhibition

DUBILIER

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON W.3.
Phone: ACOrn 2241
Grams: Hivoltcon Wesphone London.
DN 204A

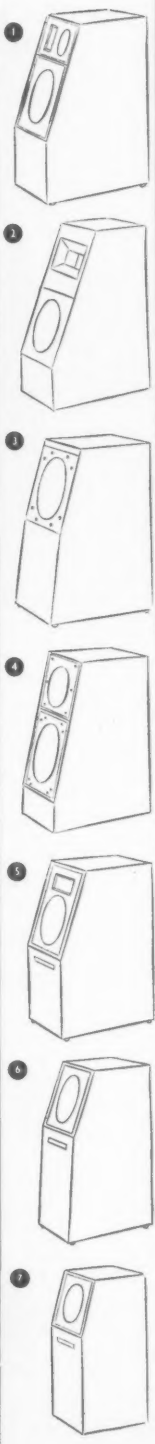
OF GROWING IMPORTANCE

is the D.C.R. 12.D Loudspeaker Cabinet



Originally designed to coax the last word in realism from the excellent Tannoy 12in. dual concentric speaker, it has proved itself to be the most effective housing for all high quality wide range 12in. speakers and has given excellent results with the new Wharfedale Super 12 FS.AL. When it was designed, the only other available dual concentric speakers were the Whiteley Stentorian and the Plessey 12in. duals. Now these have been joined by two very interesting newcomers, the Altobass model 2000 and the Vitavox DU.120. There are thus as least five 12in. dual concentrics, without mentioning the longer list of fine single cone models, all looking for a good home. Once you have heard any of these in a D.C.R. 12D cabinet you will know that it has come home for good—for your good.

1. D.C.R. 15.8.T. 2. D.C.R. 15.P.M.T. 3. D.C.R. 15.D. 4. D.C.R. 12.8. 5. D.C.R. 12.T. 6. D.C.R. 12.D. 7. D.C.R. 12 Minor.



E · M · G

HANDMADE GRAMOPHONES LTD.
6 Newman Street, W.1.
MUSeum 9971.

more and more companies are specifying

merad

the first irradiated polythene equipment wire in the U.K.

MERSEY CABLE WORKS LTD • Liverpool 20

A COMPANY

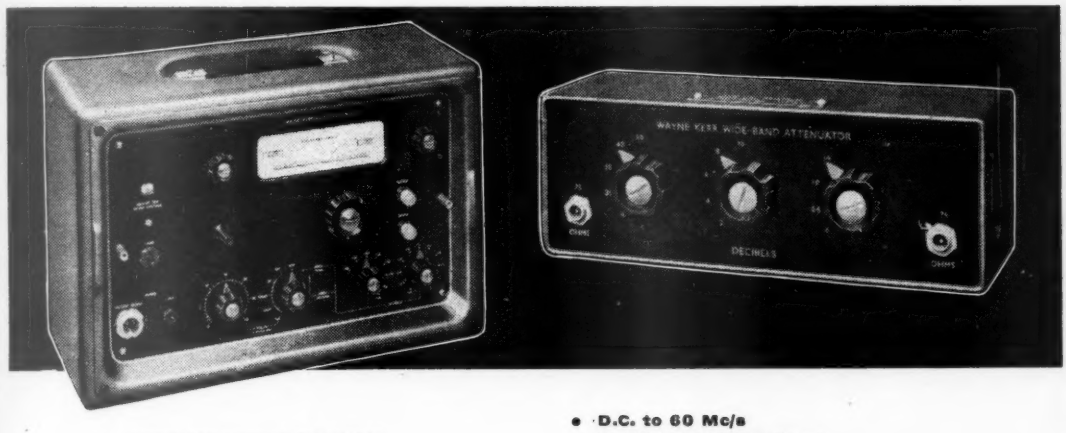
MCW6

WAYNE KERR INTRODUCE

Two new instruments

WIDE RANGE AUDIO OSCILLATOR S.121

WIDE BAND ATTENUATOR Q.251



- Rapid Frequency Selection
- High Stability
- Low Distortion

- D.C. to 60 Mc/s
- 0—60dB in 0·5dB steps
- 75Ω Characteristic Impedance
- Accuracy D.C. to 20Mc/s 0·1dB, 60Mc/s 0·3dB

The S.121 is a high grade instrument providing a stable signal of very low harmonic content within the frequency range 10c/s—120kc/s.

The dial display is designed for simple and rapid operation and permits either the selection of major intervals by means of switches, or the continuous fine control of frequency on an open horizontal scale.

Two alternative outputs are providcd. A step attenuator covers +10dB—70dB in 1dB steps on a reference level of 1 milliwatt into 600 ohms. The second output provides a continuously variable voltage from 0—30V in five decade ranges. The stability of the output level is ±0·2dB over the whole frequency range. Despite its high performance the instrument is compact, light and portable.

A light, compact, variable attenuator for use in the frequency range 0—60Mc/s. The instrument, which has a high performance, is rigidly constructed and is suitable for bench use or as a unit for incorporation in laboratory and test equipment. **PRICE £30**

SPECIFICATION OF AUDIO OSCILLATOR S121

MAINS INPUT
110/120V or 200/250V, 50/60c/s.

FREQUENCY
Range: 10c/s to 120kc/s.
Accuracy: ±1%±0·5c/s.

OUTPUT
1. 600Ω unterminated
2. 600Ω terminated
3. 0 to 30V variable impedance source.

OUTPUT LEVEL
Stability: 600Ω output±0.2dB

WAVEFORM DISTORTION
300c/s to 20kc/s <0.2%,
10c/s <2·5%, 100kc/s <0.4%

HUM LEVEL
<—60dB below fundamental

WEIGHT 17 lbs.

PRICE: £130

WAYNE KERR

WAYNE KERR LABORATORIES LIMITED, ROEBUCK ROAD, CHESSINGTON, SURREY. TELEPHONE: LOWER HOOK 1131

NEW

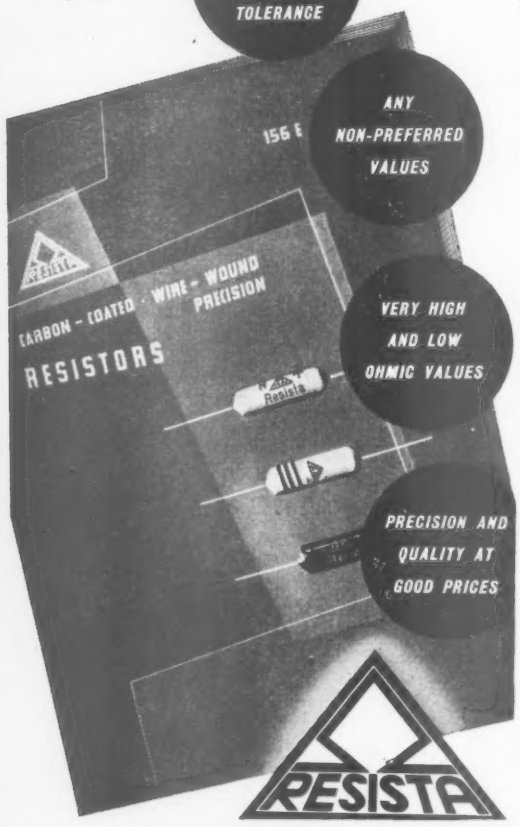
HIGH STABILITY CARBON AND WIRE WOUND RESISTORS

G. A. Stanley Palmer, Ltd., announce a completely new and comprehensive range of wire wound and high stability carbon resistors. These will prove invaluable to the manufacturer of high quality equipment and assist substantially in relieving his overall production costs.

HIGH STAB TO ±0.5% STABILITY AND TOLERANCE

WIRE WOUND TO ±0.02% TOLERANCE

Catalogue available on request.


ANY NON-PREFERRED VALUES
CARBON - COATED · WIRE - WOUND PRECISION
RESISTORS
VERY HIGH AND LOW OHMIC VALUES
PRECISION AND QUALITY AT GOOD PRICES
RESISTA

G. A. STANLEY PALMER LTD

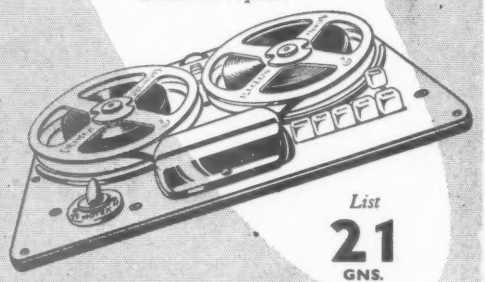
Maxwell House, Arundel Street, Strand, W.C.2. Phone Temple Bar 3721

UaG

Years of experience and technical skill combined with many outstanding features including **three speed control knob** make this a truly fine Deck.

MOTEK K9

Patents pending. Details on request.



List 21 GNS.

MODERN TECHNIQUES

Wedmore Street, London, N.19. Tel: ARChway 3114

POTentiometer LOCKS

KNOB LOCK

The ideal method of locking panel mounted controls. Positive guard against vibration, etc.

PRE-SET CONTROL LOCK

TYPE P.K.2

Very attractive appearance for panel mounting.

TYPE C.H.2

These units are designed to lock the spindles of pre-set potentiometers or trimmers without rotational or lateral displacement of shaft. Will accept wide range of panel thicknesses Send for leaflet A.I.

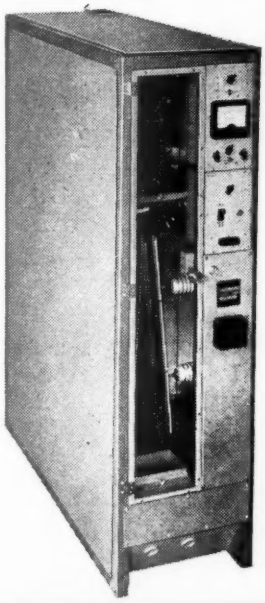
This development of our popular pre-set control lock is finished in black plastic and embodies control knob and instantaneous finger-tip locking knob. Send for List No. A.6.

Prices reduced!

Have you had a copy of our revised Knob Lock price list?

SCEE LTD. REDDICAP TRADING ESTATE SUTTON COLDFIELD

Phone: SUT 3038 & 5665



TYPE VA 25S

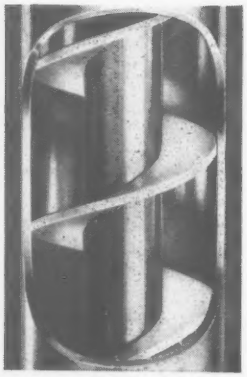
The Sortex G.2. Electronic Separator illustrated by courtesy of R.W. Gunson (Seeds) Ltd., incorporates 'Cintel' photocells and is just one of the many examples of the use of 'Cintel' cells in industrial equipment. In a fact there is a 'Cintel' cell for almost every known application.

PHOTO CELLS IN ACTION

✻ **over 100 cell types in the current catalogue. Full data on request.**

WORSLEY BRIDGE ROAD
LOWER SYDENHAM • LONDON SE26
A Company within the Rank Organisation Ltd. **HITHER GREEN 4600**

CINTEL



Illustrated is the HM.10. Helical Membrane Cable, which has a power handling capacity of 20 kW at 100Mc/s.

Many well-known companies in the field of electronics have turned to Telcon for advice on the all important applications for Telecommunications. The knowledge and experience of Telcon staff—scientists, research engineers, chemists, cable designers and technicians, which has been gained in all parts of the world, is always at the service of cable users and equipment designers.

The Telcon Contracts Department is organised to supervise or undertake the installation of any of the more highly specialised types of cable manufactured. Its services are particularly valuable in cases where unfamiliar techniques are involved.

Cables for Telecommunications

Coaxial and balanced power cables for telephonic communications are in standard production, as well as very low loss Helical Membrane Cables, for Multi-channel Radio links and Television Transmitting Feeders, etc.

You are welcome to full details and specifications of any of these types. When writing please quote reference WW.

TELCON CABLES

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE CO. LTD.,

Mercury House, Theobald's Rd, London, W.C.1. Telephone: HOL 8711.

Branches at: CARDIFF·DUDLEY·MANCHESTER·NEWCASTLE·NOTTINGHAM.

An Audio Frequency Cable for local distribution purposes. These types can be installed underground, overhead or underwater, as required.

EXECUTIVES REQUIRE CRISP, CONCISE REPORTS—DICTATE THOSE DETAILS IN YOUR CAR! VALRADIO DC/AC CONVERTERS MAKE DICTATING MACHINES AND TAPE RECORDERS MOBILE

For use too with Record Changers, Radiograms, Electric Gramophones, Television Receivers, and T.V. from country house lighting plants. (Prices according to instrument.)

INPUTS . ENTREES . ENTRADAS
6, 12, 24, 32, 50 110 or 200/250 v.
OUTPUTS . SORTIES . SALIDAS
110 v. or 230 v. AC, 50 or 60 c/s. 30 to 300 w.

Prices DC/AC Converters:
From £3/18/—for Small Motors.
From £12/15/—for Radiograms (including 3-speed Types).

Units complete and ready for use. **VALRADIO.** ***Write for descriptive folder, WW/C. ACCEPTED AS THE STANDARD by*** **RADIO MANUFACTURERS, the Trade and the Aircraft industry.**

Les rapports destinés aux chefs de service doivent être rédigés d'une façon bien concise—dictez-les donc dans votre voiture!
Les convertisseurs C.C./C.A. "VALRADIO" consentent la mobilité aux machines à dicter et aux enregistreurs sur bandes.
Ils peuvent également être utilisés pour changeurs de disques, appareils combinés, électrophones, téléviseurs, etc., partant d'installations d'électricité, particuliéres.

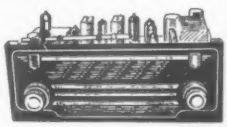
Las relaciones destinadas a los jefes tienen que redactarse de modo muy conciso—dictenlas en el coche!
Los inversores C.C./C.A. "VALRADIO" les prestan movilidad a las màquinas de dictar y a los grabadores de cinta.
También pueden utilizarse para cambiadores de discos radio-combinados, gramófonos eléctricos aparatos de televisión, etc., aprovechando las instalaciones eléctricas privadas.

Specialist in converters since 1937. **VALRADIO LIMITED, BROWELLS LANE . FELTHAM . MIDDX. Phone: Feltham 4242/4837**
OVERSEAS ENQUIRIES TO:—DEMANDES D'OUTRE-MER A:—TODA INFORMACION DE EXPORTACION HA DE PELIRSE A:—E.M.I. SUPPLIES LTD. . HAYES . MIDDLESEX . ENGLAND

HI-FI EQUIPMENT

(CABINETS See page 78)

RADIO CHASSIS



Empress 9-valve de luxe AM/FM with two speakers	26 gns.
Empress 6-valve AM/FM with 10in. speaker	22 gns.
Empress 6-valve de luxe AM/FM self-powered tuner	22 gns.
Empress FM Tuner	£13/15/-
Empress 5-valve AM	£14/5/-
Armstrong PB 409 9-valve AM/FM 6-watt push-pull	28 gns.
AF 105 10-valve AM/FM 10-watt push-pull	£37

DULCI

H.3 AM/FM 3 wavebands	£20 17 0
H.4 AM/FM 4 wavebands	£24 6 6
H.4.PP AM/FM push-pull 4 waveband	£29 3 10
H.4.T AM/FM self-powered tuner	£20 17 0
H.11 AM/FM tuner with pre-amplifier	£29 3 10
FM self-powered tuner	£17 10 3

AUTOCHANGERS

Garrard	
RC 98/4	£19 17 7
RC 88/4	£17 18 8
RC 120/4	£12 17 2
RC 121/4	£13 13 10
Collaro latest	£9 19 6
B.S.R. Monarch	£8 15 0

TRANSCRIPTORS

Garrard 301	£26 8 3
Connoisseur	£28 11 0
Goldring-Lenco 56	£23 7 10
Collaro 4T200	£19 10 0
Garrard TA Mk. 2	£9 15 8
Collaro AC4/564	£9 7 0

Tape Decks with Pre-Amplifier, absolutely complete ready to connect to radio or amplifier:

Collaro/Magnafon Mk. IV	40 gns.
Telefunken	£47 10 0
Brenell	£40 8 6
Truvox Tape Deck 29 gns., with amplifier	£47 19 0
Motek Tape Deck K.9	21 gns.
Wearite Tape Deck 3B	£40 0 0

Send for Catalogue of complete range of Hi-Fi Equipment Cabinets, etc. All available on easy Hire Purchase.

LEWIS RADIO

120 (Dept. 458), Green Lanes (Nr. Cock), Palmers Green N.13 Tel.: Bowes Park 1155/6

Our new Series 335 sub-miniature relay (shown here actual size) is very reliable and produces remarkably high contact pressures.
Weight: Approximately ¼ oz. Contact arrangement: D.P.C.O. Contact rating: 2A resistive load at 30V. D.C. or 115V. A.C. Nominal coil voltages: 6, 12, 24 & 48V. D.C. Max. continuous coil rating: 1¼W. Dimensions: 0.80" wide by 0.34" thick by 1" high, including pins. Max. coil resistance: 5000Ω.

AID & ARB APPROVED

MAGNETIC DEVICES LTD **NEWMARKET SUFFOLK**

Telephone: Newmarket 3181 **Telegrams: Magnetic Newmarket**

THE WEYRAD AM/FM RECEIVER

THIS RECEIVER WHICH HAS BEEN SPECIALLY DEVELOPED FOR THE AMATEUR CONSTRUCTOR PROVIDES COMPLETE COVERAGE OF THE SOUND BROADCAST BANDS—LONG, MEDIUM AND SHORT WAVE AM. WITH 87.5-100 Mc/s. V.H.F. FOR FM. WE HAVE PRODUCED A FULLY ILLUSTRATED BOOKLET WHICH GIVES INFORMATION ON THE ASSEMBLY AND ALIGNMENT OF THE 4-BAND SEVEN-VALVE RECEIVER, INCLUDING CHASSIS LAYOUT, CIRCUITS AND POINT-TO-POINT WIRING DIAGRAM.

★ " WEYRAD " B.61 COIL PACK, P.23 I.F. TRANSFORMERS, T.S.61 TUNING SCALE, Q2 I.F. FILTER, E.822 MAINS TRANSFORMER AND E.823 OUTPUT TRANSFORMER.

★ ALUMINIUM CHASSIS WITH ALL PUNCHING AND BENDING COMPLETE.

★ DESIGNED FOR LATEST TYPE MULLARD VALVES.

★ RECEIVER OUTPUT CAN BE MODIFIED FOR USE AS A RADIO FEEDER FOR QUALITY AMPLIFIERS.

THE BOOKLET & PRICE LIST ..... **2/6d.**

ILLUSTRATED FOLDER OF A.M. COMPONENTS..... **3d.**

WEYMOUTH RADIO MANUFACTURING CO., LTD.

CRESCENT STREET, WEYMOUTH, DORSET

LIST PRICE **£8.5.0** complete with test leads and prods.

THE "ASHMORE"

NEW AC/DC TEST SET

15 RANGES Selected by Switch

D.C. Volts	A.C. Volts	D.C. Current	Resistance
0—10	0—10	0—1 mA	0
0—25	0—25	0—10 mA	to
0—100	0—100	0—100 mA	50,000 ohms
0—250	0—250	0—1 Amp.	
0—1,000	0—1,000		

Accuracy 3% all ranges. 1,000 ohms per volt.

- **High Stability Resistors on volts ranges.**
- **Wire Wound Shunts on current Ranges giving the instrument LONG TERM accuracy.**
- **Instrument mounted on engraved Panel and fitted into a strong hardwood case.**
- **All components may be replaced easily should the instrument become damaged.**
- **Size 5½ x 4½ x 2½in. Weight approx. 1 lb.**
- **A High Quality Test Set at moderate price.**

E.I.R. INSTRUMENTS LTD.

329 Kilburn Lane, London, W.9. *Tel: LADbroke 4168.*

WE SPECIALISE IN SOUND RECORDING AND REPRODUCING EQUIPMENT

E.A.R. '1960' Portable

Inspect our most varied stock of all well-known makes— E.A.R., Goodmans, Quad, Leak, Rogers, Wharfedale, Sound, Grundig, W.B., Garrard, Jason, Connoisseur, etc., etc.

E.A.R '1960' Chairside

SPECIAL OFFER THIS MONTH

The famous SOUND Tape Recorder for only 55/- deposit and 8 equal monthly payments of 137/6 — delivery after first payment — NO INTEREST CHARGES.

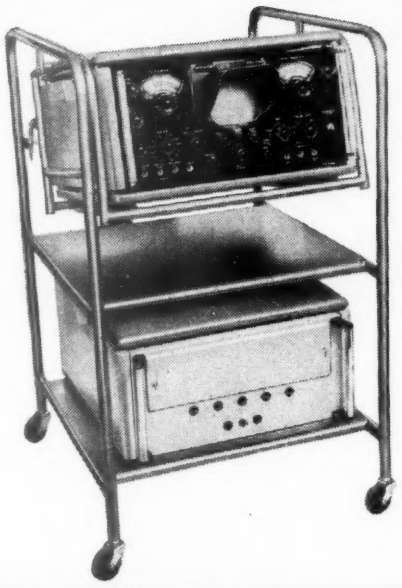
CASH PRICE 55 GNS.

If you cannot call — use our Mail Order Service — let us have your enquiries by return

M·O·S The E & G Radio Centre Ltd.

33 Tottenham Court Road, London, W.1

Telephone: Museum 6667



D.C. to 25 Mc/s with 6 cm Deflection

With a rise time of 14 millimicroseconds, 10 kV p.d.a. and sweep speeds up to 30 milli-μsec/cm, the L.155 Oscilloscope is particularly suitable for the display of very fast transients; but combined with these high speed display characteristics is a measuring system that gives great accuracy coupled with simplicity of operation.

This latest Mullard Oscilloscope embodies the same time and voltage measuring system incorporated in its predecessor the L.140, which after extensive use has proved completely reliable. The claim that the accuracy is within ± 3% is a very modest one—each instrument has to meet much tighter tolerances in production—but this figure refers to the actual quantity measured, down to one-third of full scale, and is furthermore the long term accuracy.

The three-stage directly-coupled Y amplifier gives a maximum sensitivity of 150 mV/cm with a bandwidth extending from d.c. to 25 Mc/s. (–3dB). Printed wiring on a special low-loss board is used to minimise variations of stray capacitance. The display tube used gives up to 8 cm Y deflection, and sufficient drive is available from the Y amplifiers to give 4 cm deflection at 30 Mc/s.

A delay can be switched into the signal path; the delay comprises a length of 75 ohm coaxial line and does not affect the bandwidth of the amplifier.

The triggered time-base can be locked to signals at any frequency between 5 c/s and 25 Mc/s or will operate at a pre-determined voltage level. The time-base ranges are from 1.5 μsec to 150 msec and a times 5 sweep expansion is available on all ranges; sweep expansion does not affect the accuracy of time measurement.

The power supply unit, which is contained in a separate cabinet, provides stabilised voltages which ensure that the measuring accuracy is unaffected by mains variations of up to ± 10%.

A tubular metal trolley is available to carry both the oscilloscope and the power supply unit.

BRIEF SPECIFICATION

Y Amplifier

Bandwidth	D.C.–25 Mc/s (70%); useful response to 40 Mc/s.
Sensitivity	150 mV pk-pk/cm to 45 V pk-pk/cm in six steps.
Input Impedance	400 kΩ + 10pF—high sensitivity 400 kΩ + 20pF—low sensitivity 75Ω when using internal delay
Voltage Measurement ..	By null method: accurate to ± 3% from 500 mV to 300 V
Signal Delay ..	0.15 μsec. (switchable)

Time-Base

Sweep Duration ..	1.5 μsec to 150 msec in 11 ranges
Time Measurement ..	Accurate to ± 3% of time interval measured from 0.1 μsec to 150 msec.
Trigger Sensitivity (Internal)	1 cm positive or negative pulse, or sine wave 5 c/s to 500 kc/s. With increased amplitude the time-base can be synchronised with sine waves up to 25 Mc/s.
(External)	1V positive or negative pulses, or sine waves 0.7 V r.m.s.

Cathode Ray Tube

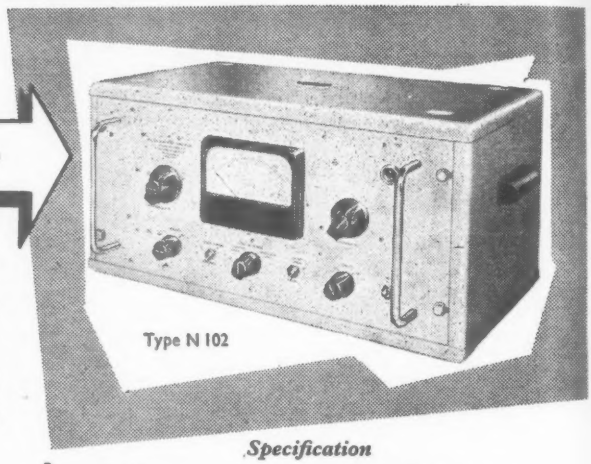
Mullard DG13–97/5BKP1, with 10 kV p.d.a.
The display is masked to 9.4 cm square, and the maximum Y deflection is 8 cm pk-pk.

Mullard
SPECIALISED ELECTRONIC EQUIPMENT

MULLARD LIMITED · MULLARD HOUSE · TORRINGTON PLACE
LONDON · W.C.1 · TELEPHONE: LANgham 6633

ME 623

Scanning pulse amplitude analyser



The Dynatron Scanning Pulse Amplitude Analyser, Type N 102, is an ideal instrument for use in Gamma Spectrometry, and is highly suitable for use with scintillation counters. A toggle switch on the front panel enables the N 102 to be converted into a simple discriminator.

The output of the Analyser may be fed to a Scaling Unit or a Ratemeter. Should a Ratemeter be used, its output can be fed into a chart recorder, with suitable sensitivity and chart-speed facilities, and a continuous spectrum analysis obtained.

Specification

Input: Positive.

Length: 0.5 μsec. Minimum.

Amplitude: Range of measurement, 5-50v. and 5-100v.

Sweep Speed: 1 v./min. 50v. range; 2v/min. 100v. range.

Stability of Threshold: 0.1v.

Channel Width: Variable 0-10v. or 0-50v. Stability ±1%. Accuracy ±2%.

Output Pulse: Positive. Amplitude on open circuit 20v.

Resolving Time: Less than 1 μsec.

Accuracy in Pulse Height: ±2%.

See this and other DYNATRON instruments on STAND 918 at the INSTRUMENTS, ELECTRONICS and AUTOMATION EXHIBITION, Olympia, 16th to 25th APRIL.

DYNATRON

NUCLEONIC & ELECTRONIC DEPT.
Dynatron Radio Ltd.,
Maidenhead, Berkshire

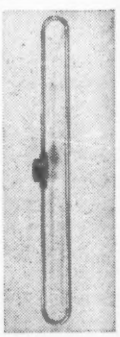
Scalers · Pulse Generators · Pulse Analysers · Power Units · Probe Units · Pulse Amplifiers · Instrument Racks

TRANSFORMERS
COILS LARGE OR SMALL QUANTITIES
CHOKES TRADE ENQUIRIES WELCOMED
SPECIALISTS IN
FINE WIRE WINDINGS
MINIATURE TRANSFORMERS, PICK-UP
CLOCK AND INSTRUMENT COILS, ETC
VACUUM IMPREGNATION TO APPROVED STANDARDS
ELECTRO-WINDS LTD.
CONTRACTORS TO G.P.O. M.O.S., I.T.B., ETC
123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY
LIVINGSTONE 2261 EST 1933

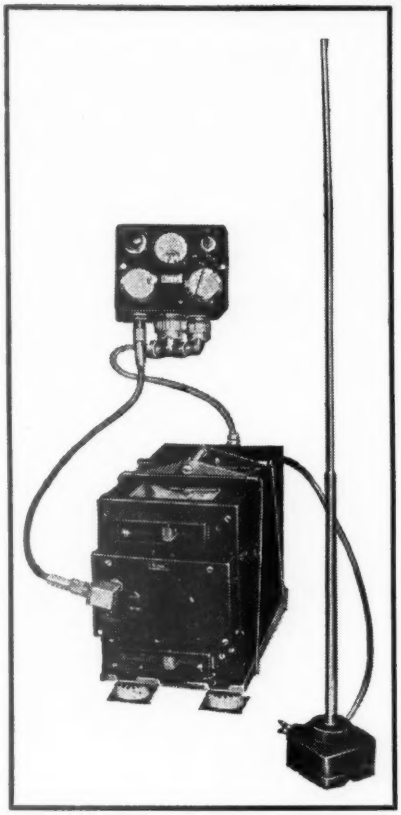
Insulating Sleevings
P.V.C.
and POLYTHENE
SLEEVINGS
INSULATED WIRES
and FLEXIBLES
A.I.D and A.R.B. Approved
PLASTICABLE LIMITED
HAWLEY LANE
FARNBOROUGH, HANTS
Phone: FARNBOROUGH, HANTS 85

TELEVISION AERIAL COMPONENTS
DESIGNED FOR CONSTRUCTING BAND I & BAND III T.V. AERIALS
ELEMENT DIMENSIONS SUPPLIED FOR ALL CHANNELS
Selecting at random from our new multi-page catalogue:

★ Band III Folded Dipoles (As illustrated)
★ Reflector and director rod holders
★ Masthead Fittings for ¾", 1", 1½" and 2" Masts
★ Mast Coupling units for 2" Masts
★ Insulators, both Rubber and Plastic (As illustrated)
★ Alloy Tubing for Elements, Cross boom and masting



Send 1/- P.O. for the revised, fully illustrated catalogue to:
FRINGEVISION LTD., Marlborough, Wilts. **Phone 657/8**



17·6 lb of well-designed equipment

That's the gross weight of this Plessey V.H.F. Transmitter-Receiver. Not only is it light in weight, it is compact in design, making the whole an economical unit for light or medium aircraft.

These are a few of the reasons why the Plessey Type PTR 61 V.H.F. Transmitter-Receiver is used by the Royal Air Force, the Air Forces of Holland, Belgium, Pakistan and Portugal, and many international airlines.

- The combined weight of the transmitter-receiver (which includes the power unit) and the remote controller is 17.6 lb.
- Built-in noise limiter reduces impulse interference.
- Single knob tuning for both transmitter and receiver.
- 6 channels, crystal controlled.
- Power consumption 60 watts approximately.

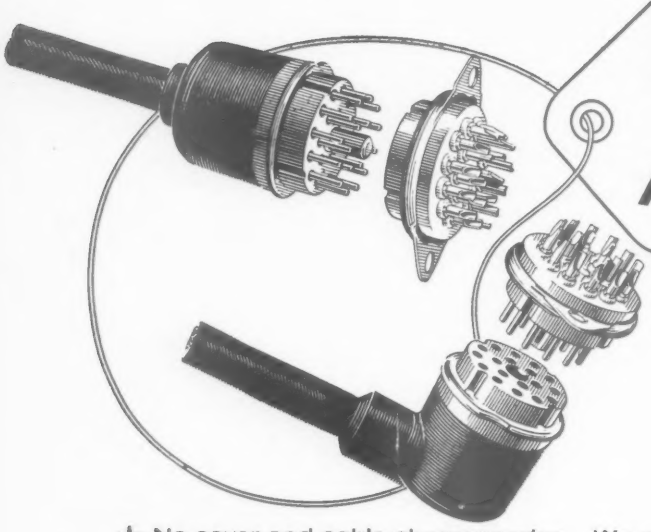
The equipment provides V.H.F. radio telephone communication facilities on any one of six crystal-controlled channels in the aeronautical communication band 116-132 Mc/s. The range to be expected at 3,000 feet is 50 miles and in practice this is often greatly exceeded. The PTR 61 is designed principally for use in private or training aircraft, but will find many applications wherever compact and economical equipment is required.

- Crystals and channel frequencies can be changed in flight if required.
- Transmitter carrier power 1.25 watts minimum.
- Fully tropicalised.
- Intercommunication facilities up to three positions.
- Remote controls available.
- ARB and AID approved.

Plessey

ELECTRONIC AND EQUIPMENT GROUP
ELECTRONICS DIVISION
THE PLESSEY COMPANY LIMITED · ILFORD · ESSEX
Overseas Sales Organisation:
Plessey International Limited · Ilford . Essex · ILFORD 3040

S1.3a



McMURDO Potted Pakonectors

18 WAY

★ No cover and cable clamp worries. We connect your cable to plug or socket and pot the assembly in polythene. ★ 18 connections in less than 1 inch diameter. ★ Standard B9A valveholder mounting. ★ Nylon loaded P.F. mouldings. ★ Cadmium plated or gold plated pins and contacts.

Send for full details to:—

THE McMURDO INSTRUMENT CO. LTD., ASHTEAD, SURREY. Tel: ASHTEAD 3401

MPCI9

ELGE RADIO PEN

Versatile pocket Fault Finder

For
Radio
Television
Amplifiers
Transmitters
Electronic Equipment

Combined Neon-Tester and Saw-tooth Generator

Ideal for *on-the-spot* Voltage measurements; Signal tracing (A.F., I.F., R.F.); Valve and component checking; Polarity and mains indications; Spark plug testing.

An Invaluable Field-Service Aid

Price **24/-**
(Carriage paid)

MERCIA ENTERPRISES LIMITED
Godiva House, Allesley Old Road, Coventry
Telephone 2279

S.A.E. for illustrated leaflet. Trade Enquiries invited

● MULTIMETERS ● OSCILLOSCOPES ●

SIGNAL GENERATORS

TEST EQUIPMENT REPAIR

FREQUENCY METERS

COLLECTION & DELIVERY 100 miles radius
(OVER 100 MILES BY ARRANGEMENT)

BACK TO *YOU* IN *7 DAYS* (with few exceptions)
AUTOMATION & ELECTRONIC MAINTENANCE ENGINEERS

Repairs, Calibration and Overhaul of —
All leading makes of English and American Electrical and Electronic Test Equipment

TEST EQUIPMENT REPAIR
LEIGH ROAD, **LEIGH,** LANCS. TEL: LEIGH 1687

● PATTERN GENERATORS ● MEGGERS ●

CABINETS

MANY & VARIED DESIGNS IN BUREAU PIANO, CONSOLE AND TABLE MODELS

THE **RECORDAGRAM BUREAU CABINET**

This is an entirely new design cabinet in the bureau style. It is pleasingly finished in medium walnut high polished veneer. Plinth and hinge board in black ebony finish. Very large speaker vent in gold expanded aluminium. Both control aperture and motor board supplied uncut.

Overall size as follows:—
Length 2ft. 8in. Height 2ft. 7½in. Maximum Depth 1ft. 3½in. Minimum Depth 11½in. Motor Board size: 17 × 13in. Control Panel size: 14½in. × 12in. Easy file cut for 8in. P.M. speaker. Ample storage space Height 14in., depth 14in., width 14½in.

Send also for our detailed wholesale list for cabinets, wire chassis FM/AM. Complete TVs. Radio Aerials. Convertors & sundry Electrical components e.t. Shavers, etc.

V.E.S. WHOLESALE SERVICES Ltd.
Dept. (W.W.), 11, Gunnersbury Lane, Acton, W.3
Trade only supplied Tel.: ACOrn 5627

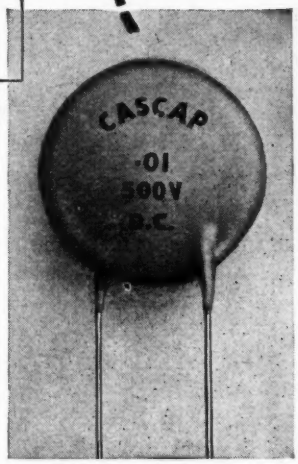
limited space

THERE'S

THE

PLACE

for **Plessey** "CASCAP"



CERAMIC DISC CAPACITORS

With the birth of CASCAP, many of the inherent difficulties in the design and production of certain types of Radio and Electronic equipment were instantly overcome. They were, of course, mainly considerations of space and economy in relation to the final product's performance. Compact, reliable and inexpensive, CASCAP capacitors ranging in value between 0.0005 mfd. and 0.01 mfd. are readily available. They are ideal for radio and electronic applications such as R.F. decoupling where precision of capacitance value is not of primary importance.

A NEWER APPLICATION. The present-day demands for compact items of electrically operated merchandise—mostly in the mass consumer field—give CASCAP a new and important role to play.

In view of the legal obligation to install suppressors in such products as electric razors, hair driers and the like and the space limitation factor in fabrication, CASCAP certainly provides a timely answer to what would otherwise have been a considerable problem to manufacturers.

Further information is supplied in Plessey Data Sheet No. 5020. A copy will be mailed, together with a sample Cascap Capacitor, at your request.

COMPONENTS GROUP · CHEMICAL AND METALLURGICAL DIVISION

THE PLESSEY COMPANY LIMITED · WOOD BURCOTE WAY · TOWCESTER · NORTHANTS · TEL: TOWCESTER 312

Overseas Sales Organisation: PLESSEY INTERNATIONAL LIMITED ILFORD ESSEX · ENGLAND · TELEPHONE: ILFORD 3040

"YOU CAN RELY ON US"

Stockists of all Radio and Electronic components for manufacturers, laboratories, Educational authorities and the amateur

THE NEW AVO MULTIMINOR
Price £9.10.0 Leather Case 32/6
or 9 payments of 23/3
or Deposit 63/4 and 6 payments of 22/2

COSSOR 3v 3W Hi-Fi Amplifier Kit
Complete with twin speakers
Beautifully kitted and printed circuit.
£9.15.0 or Deposit 65/- and 6 months at 23/4
or Deposit 23/10 and 8 months at 23/10

ALL OTHER AVO INSTRUMENTS IN STOCK

RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5 *Telephone : EAL. 5737*
Next to South Ealing Tube TURN LEFT) 9 to 6 p.m., Wednesday 1 o'clock.

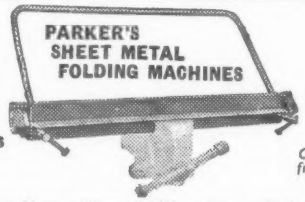
Hi-Fi Furniture in the contemporary trend

The illustration shows the NORDYK range, from left to right the SPEAKER ENCLOSURE or 8" or 10" speaker £5.17.6d.; RECORD UNIT holding 150 records £4.17.6d.; GRAM. UNIT for tape deck or gram. turntable £5.19.6d.
Send for full details and nearest stockist to:—

RECORD HOUSING Dept. WW84, Brook Rd. London, N.22
Phone BOWes Park 7487/8

PARKER'S SHEET METAL FOLDING MACHINES

HEAVY DUTY VICE MODELS WITH BEVELLED FORMER BARS



Carriage free

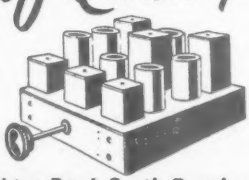
No. 1 Cap. 18 ga. mild steel x 36in. wide... £7 10 0
No. 2 Cap. 18 ga. mild steel x 24in. wide ... £5 5 0
No. 3 Cap. 16 ga. mild steel x 18in. wide... £5 5 0
Form Angles, Channels. End folding attachments for Radio Chassis, Tray and Box making. For 36in. model, 3/6 per ft., other models 2/-.
The two smaller models will form flanges.
One year's guarantee. Send for details.

A. B. PARKER, Wheatcroft Works
Wellington Street, Batley, Yorks. Tel. 436

The Osmor "SATELLITE" F.M. RECEIVER

a Sensitive Unit of Quality

A completely stable and drift-free tuner for adding to an existing radio or radiogram, or hi-fidelity amplifier. Installation is simple and convenient because of the small size of the unit and the fac that a tuning scale is not required. The special frequency control circuit ensures that the switch-tuned stations are held precisely.
Complete Kit £7/5/- (less valves).



Get these FREE CIRCUITS & WIRING DIAGRAMS

T.R.F. Circuits
Battery Circuits
Portable Circuits
S'het Circuits
Mains Circuits
Filter Circuits
T.V. Converter Circuits, etc., etc.

Send 1/- in stamps for the lot!

OSMOR Dept. (WW21) 418 Brighton Road, South Croydon, Surrey Telephone Croydon 5148/9 OSMOR

There can be no doubt

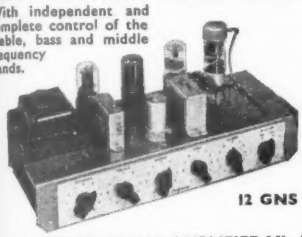
whatsoever that "Symphony" products represent the greatest value-for-money on the market to-day

A demonstration will prove to you that the results obtained from our "Symphony" amplifiers, Tuners, Tape Recorders, etc., are of the highest order. This is coupled with sheer long-term reliability.

HOW IS ALL THIS POSSIBLE? We are not subsidised by the State or other body. It is possible because WE SUPPLY DIRECT TO THE PUBLIC and give you what would otherwise be discount to the Trade.
Call for a demonstration any day between 10 a.m. and 6 p.m. except Sunday or send 6d. in stamps to cover postage on our latest catalogue giving details of the following and a host of other High Fidelity equipment. It is essential to quote "Wireless World" when replying to this advertisement.

No. 1 "SYMPHONY" AMPLIFIER Mk. III

With independent and complete control of the treble, bass and middle frequency bands.



12 GNS

No. 2 "SYMPHONY" AMPLIFIER Mk. III

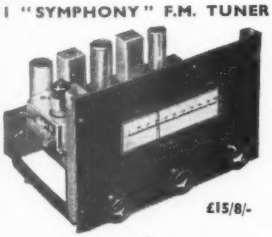
17 GNS

"SYMPHONY" AMPLIFIERS with REMOTE CONTROL

Enables the amplifier proper to be set in the bottom of a cabinet whilst the controls are mounted conveniently higher up. **2 GNS extra.**

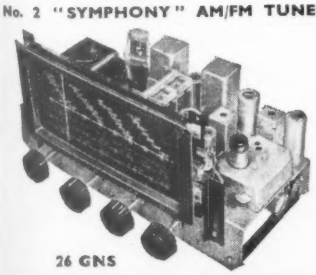
No. 2 PUBLIC ADDRESS AMPLIFIER Mk. III
15 GNS.

No. 1 "SYMPHONY" F.M. TUNER



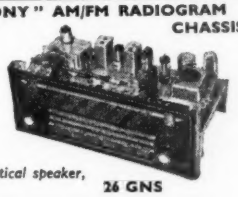
£15/8/-

No. 2 "SYMPHONY" AM/FM TUNER



26 GNS

"SYMPHONY" AM/FM RADIOGRAM CHASSIS



including elliptical speaker,
26 GNS

GRAMOPHONE & TRANSCRIPTION UNITS by:
Garrard, Collaro, Lenco, Woollett, Connaisseur, B.J., etc.

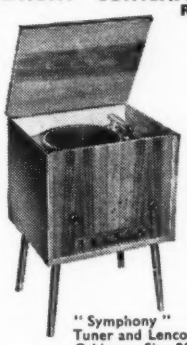
NORDYK CABINETS
All models stocked.

Installations in Cabinets
We can supply any equipment advertised in any cabinet advertised.

AUDIO FAIR

Again we have decided to hold our AUDIO FAIR at our own showrooms in Swiss Cottage, where, we feel the conditions for careful consideration and trial of apparatus will be better than at the Waldorf,
Do not fail to visit us, therefore, when in London for the Fair. We shall be demonstrating continuously from 9 a.m. to 6 p.m. daily on the 18th - 19th - 20th - 21st April.

"SYMPHONY" CONTEMPORARY REPRODUCER



"Symphony" Amplifier, FM Tuner and Lenco Unit in Nordyk Cabinet. Size 20in. wide x 17in. high x 17in. deep, at **9 GNS** complete with legs.

W.B. "PRELUDE" CONTEMPORARY BASS REFLEX CONSOLE CABINET 11 GNS

W.B. "PRELUDE" CONTEMPORARY HI-FI CONSOLE CABINET, 13 GNS

W.B. "PRELUDE" CONTEMPORARY BASS REFLEX CORNER CONSOLE, 10 GNS

SPEAKERS by:
Wharfedale, Goodmans, Whiteley (W.B.), Lorenz, Grampion, C.Q., etc.

NORTHERN RADIO SERVICES

11 KINGS COLLEGE ROAD, ADELAIDE ROAD, LONDON, N.W.3.

Phone: PRImrose 3314.

Tubes: Swiss Cottage and Chalk Farm.
Buses: 2, 13, 31, 113 and 187.

"SYMPHONY" CONCERT GRAND REPRODUCER KIT

Provides switched VHF Radio, Gramophone and Tape Record/Playback in one cabinet.

"SYMPHONY" TAPE RECORDERS

Table Model
52 GNS

Portable Model
52 GNS

TAPE EQUIPMENT by:
Truvox, Collaro, Grundig, Wearite, Ferrograph Brenneil. TAPE—all makes stocked.

AEC for MEASURING INSTRUMENTS

MOVING COIL • MOVING IRON • THERMO COUPLE • ELECTROSTATIC

IMMEDIATE DELIVERY

Most Basic Ranges available **ex-stock** for immediate despatch. Special ranges—delivery 7/14 days.

Round, Square or Rectangular patterns available, also full range of Industrial Switchboard Instruments. Portable and Laboratory Instruments.

We can supply Meters with Non-Standard Ranges in Current, Volts or Ohms. To B.S. 89. Industrial or Precision Grade accuracy.

We are now able to accept customers' own Meters for Scale Drawing and Lettering.

Clients are invited to inspect the display of instruments at our New Offices and Showrooms.

May we quote for your requirements ?

Weston Model S37. 3½" Round Flush pattern (Common dimensions by most manufacturers to K.113 Spec.)

Stockists of Meters by Weston, Turner, Baldwin, E.A.C., Weir and other leading manufacturers.

Manufacturers of Electronic Equipment to A.I.D. Standards

Contractors to G.P.O. and other Govt. Depts.

Anders Electronics LTD.

103, HAMPSTEAD RD., EUSTON, N.W.1. Tel. EUSton 1639

TRANSFORMERS

for every requirement

Electronics
Transmitters
Radar
Test equipment
M.V. discharge tubes
R.F. heating
L.V. heating

Range 1 volt—35 K.V. *1 M/A—1,000 amps*

STANDARD OR TROPICAL FINISH

We are on Admiralty and Ministry of Supply lists and A.I.D. approved

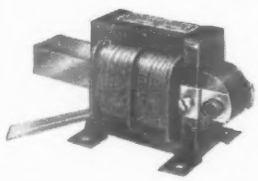
Enquiries to :

STEWART TRANSFORMERS Ltd.

75 KILBURN LANE, LONDON, W.10 · LADbroke 2296/7

A.C. SOLENOID TYPE SBM/T

GREATLY INCREASED PERFORMANCE



Continuous 3¾lbs. at 1". Instantaneous to 16 lbs. Same dimensions as Type S.B. Smaller sizes available. Greatly increased discounts for quantities. Also transformers to 7kVA 3 phase

R. A. WEBBER LTD.

18 FOREST ROAD, KINGSWOOD, BRISTOL PHONE 67-4065

RADIO & TELEVISION COMPONENTS
of guaranteed performance, reliability and long life.

ELLIPTICAL LOUDSPEAKERS. 7in. × 4in. P.M. 3/5 ohms, 17/6. Post 2/-.

V.H.F.-FM TWIN GANG TUNING CONDENSERS. 0 to 9.79 pf. Ball bearing drive end. Midget type, 5/6 each. Post 1/-.

V.H.F. AM-FM TWIN GANG TUNING CONDENSERS. 0 to 528 pf. and 0 to 10 pf. Ball bearing drive end with mounting brackets, 9/6. Post 1/-.

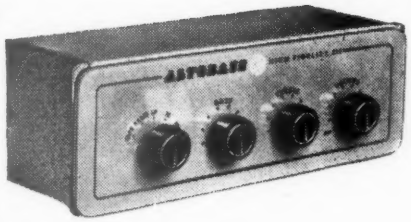
MAINS TRANSFORMERS. Primary shielded 195/250 v. Sec. H.T. 280-0-280 v. L.T. (1) 6.3 v. 3.7 amps (2) 6.3 v. 0.95 amps with mounted tag panel and provision for switch and motor. Twin fuse holder. 27/9. Post 3/-.

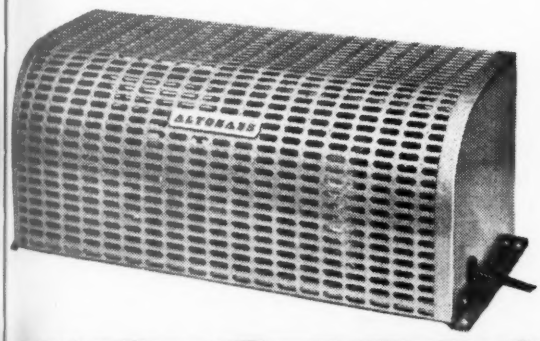
MAINS TRANSFORMER. Primary shielded 105/250 v. sec. H.T. 250-0-250 v. L.T. (1) 6.3 v. 1.78 amps (2) 6.3 v. 0.95 amps. Mounted tag panel, 22/6. Post 3/-.

PENTODE OUTPUT TRANSFORMER, for E.L.84 valve, 3/5 ohms, 5/-. Post 1/3. **DITTO,** for HN309 valve, 3/5 ohms, 6/-. Post 1/3.

The above Components are only an example of the many lines we have to offer. All Components are guaranteed clean stocks, not removed from equipment or ex-government apparatus. Send to-day 3d. stamp for our very latest lists of the many bargain lines we have to offer.

J. E. SEXTON Ltd., 162, Grays Inn Road, London, W.C.1.
Tel.: TERminus 0228-9.





THE ALTOBASS HIGH-FIDELITY 510 AMPLIFIER

- ★ *Printed circuits*
- ★ *Maximum efficiency*
- ★ *Negligible inherent noise level*
- ★ *Ultra-linear output stage*
- ★ *Greater consistency and reliability.*

Price 23 gns. Complete

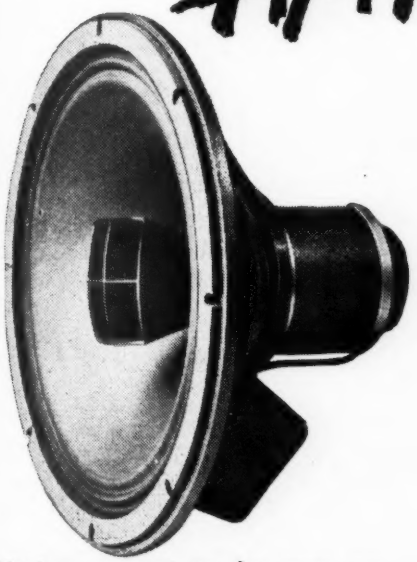
ALTOBASS

the new name in *Hi-fi*

THE ALTOBASS 2000 DUAL CONCENTRIC HIGH-FIDELITY LOUDSPEAKER

- ★ *Dual concentric assembly*
- ★ *Separate LF and HF diaphragms*
- ★ *Multicellular exponential HF horn*
- ★ *Cast aluminium chassis*
- ★ *Built-in dividing network*

Price 17 gns. Complete



These are two of the units from the Altobass range to be seen on BOOTH No. 13 and DEMONSTRATION ROOM No. 127 at the Audio Fair.

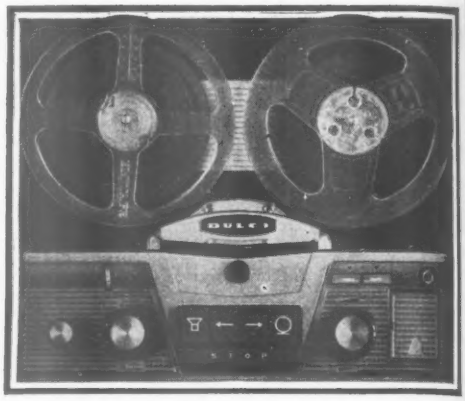
ALTOBASS LIMITED · PERCY ROAD · LEICESTER.

HERE'S the precision Tape Unit

combining superb performance and presentation. The brilliant new

DULCI Harting

High Fidelity Tape Unit



Here's something that everyone interested in sound reproduction will want to see and hear . . . a completely *new* Tape Unit all ready for addition to an existing Hi-Fi system. It's packed full of attractive features! Recording amplifier is incorporated with erase and bias oscillator. Playback equaliser and pre-amplifier is integrated with the deck.

The control panel is superbly styled in modern high impact polystyrene to give a streamlined design. *And note these refinements!* A precision numerical position indicator, electronic recording level band indicator, plus a bias control and erase cut-out switch. This allows compensation for characteristics of *any* tape, plus advantage of superimposition *without* automatic erasure.

55 GNS. including tape and spare spool

★ 2 speeds — 7½"/sec. and 3¾"/sec.
★ With calibrated compensating control for various tape characteristics.
★ Control for superimposition of new recording over old — retaining both.
★ For use in conjunction with existing audio equipment.

SUPERIOR *TAPE UNIT* FOR THE SERIOUS ENTHUSIAST

DULCI Harting

THE DULCI COMPANY LTD., 97-99 VILLIERS ROAD, LONDON N.W.2. WILLESDEN 6678/9

POLYTHENE

PROTECTIVE CAPS & PLUGS FOR STANDARD INTERNAL & EXTERNAL THREADS OR SPECIAL MOULDINGS

AMPLEX APPLIANCES (KENT) LTD.
19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT
(RAVensbourne 5531)

All export enquiries to
ANGLO NETHERLAND TECHNICAL EXCHANGE LTD.
3, TOWER HILL, LONDON, E.C.3.

EVERYTHING FOR THE AMATEUR

ALL YOU WANT AT PRICES THAT WILL ASTOUND

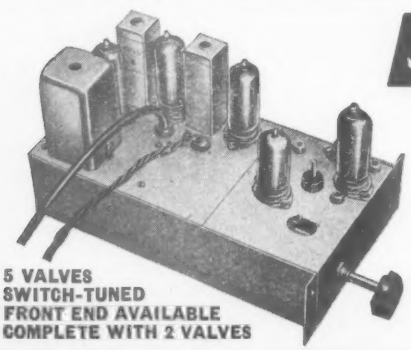
We cater for the Home Engineer, the Home Constructor, the Hi-Fi fan, the Tape Recording fan, AT THE RIGHT PRICES.

RADIO HAM SHACK LIMITED

★ *Send 1/- for the most comprehensive list yet compiled for the 'Do it yourself' enthusiast—components, materials, accessories, valves, books, etc. etc. — it will save you pounds.*

THE WEST RIDING MAIL-ORDER SPECIALISTS

RADIO HAM SHACK LTD,
155 Swan Arcade, Bradford 1, Yorks



5 VALVES
SWITCH-TUNED
FRONT END AVAILABLE
COMPLETE WITH 2 VALVES

JASON SWITCHED F.M. TUNER

A BRITISH-DESIGNED UNIT FOR THE HOME CONSTRUCTOR

When built, this new Jason F.M. Tuner provides choice of the three B.B.C. programmes at the turn of a switch, with a fourth position for "OFF." The Switch Tuned Front End is supplied wired, tested and aligned, complete with 2 valves and station-indicating plate. Chassis ready punched. In conformity with all Jason F.M. Units, this model is completely stable and offers the highest possible standards of reproduction.

CONSTRUCTOR'S SWITCH-TUNER *including assembled Front End with two valves and all parts as specified and approved come to* **£9.0.0**

SWITCH-TUNED FRONT END *with two valves, complete (incl. £1/15/0 P/Tax)* **£6.5.0**

Data Publication Book of the Tuner *(Post Paid 2/3)* **2.0**

Send for detailed list of parts—FREE.

JASON POWER PACK *Parts come to* **£2.1.9.**

FROM LEADING STOCKISTS *or in case of difficulty*
THE **JASON MOTOR & ELECTRONIC CO.**
3-4, GREAT CHAPEL STREET,
OXFORD STREET, LONDON, W.1.

UNIVERSAL ELECTRONICS

is equipped for Laboratory test and report, and calibration of communication receivers and all test equipment from D.C. to 10,000 Mc/s.

Shop hours, 9.30 a.m. to 6 p.m. Thursday 9.30 a.m. to 1 p.m.
OPEN ALL DAY SATURDAY

22-27 LISLE STREET, LEICESTER SQ., LONDON, W.C.2 *Telephone: GERrard 8410*

MARCONI LABORATORY EQUIPMENT

Reconditioned to original specification

SIGNAL GENERATORS

TF144G	85 kc/s—25 Mc/s	£75	0 0
TF390G	16—150 Mc/s	£30	0 0
TF517	150—300 Mc/s	£35	0 0

WAVEMETERS

TF643	20—300 Mc/s	£15	0 0

VALVE VOLTMETERS

TF428B		£25	0 0

IMPEDANCE BRIDGE

TF373		£65	0 0

OUTPUT METER

TF340	5mW—5W, 25—200 ohms	£30	0 0

AUDIO OSCILLATOR

TF195L	0—40,000 c/s	£65	0 0

SPECTRUM ANALYSER

TF984 S-band (10cm)
Frequency range: 2,900 to 3,150 Mc/s.
Sensitivity: 200 μW for 5 cm. deflection. 20 mean watt for 5 cm. deflection.
Spectrum width: 1 to 10 Mc/s.
Sweep frequency: 4 to 10 Mc/s.
I.F.: 22.5 Mc/s.
I.F. bandwidth: 100 kc/s for 3 db drop in level.
Quotation on request

U.S.A. Frequency Meters

L.M. SERIES

- Navy version of BC221, modulated.
- Frequency range: 125-20,000 kc/s.
- Overall accuracy: 0.1% from —32 to +65°C.

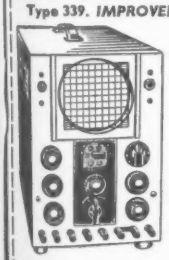
New ... £30

Also in stock:—
TS174 ... 20-280 Mc/s
TS175 ... 80-1,000 Mc/s

BC221

COSSOR Double Beam Oscilloscope

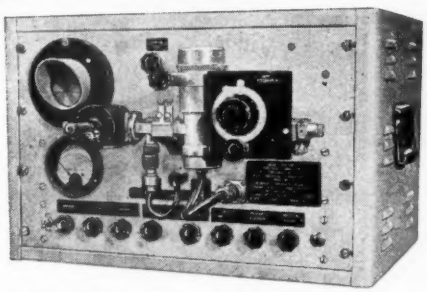
Type 339. *IMPROVED VERSION* of the *OBSOLETE* Type 3339.



Time Base Frequency. 6 to 250,000 c.p.s.
Amplifier. 43 mV RMS/mm. 10 to 100,000 c.p.s., 3db. 1.3 mV, RMS/mm. 10 to 100,000 c.p.s., 3db (2 stage).
10 mV RMS/mm. 10 to -2,000,000 c.p.s., 3db (2 stage).
Deflector Coils. 2 mm/mA RMS.
Power Supply. 110-250V A.C. 120 watts
Sensitivity. Y1, Y2 3.1V D.C. 1.1V RMS (volt/mm.) X 2.25V D.C. 0.8V RMS (volt/mm).
Screen Diameter. 114 mm. In good working condition. PRICE **£30**
Also supplied Rebuilt *to Laboratory standard and guaranteed for 3 months. Prices on request.*

SPECTRUM ANALYSER

Type TSX—4SE, 3 centimetre



The TSX-4SE Spectrum Analyser is an ultra-high frequency receiver with an oscilloscope indicator, in which the local oscillator is frequency modulated by a sawtooth voltage proportional to the sawtooth sweep on the oscilloscope tube. It is used for observing the spectra of the pulsed oscillators, tuning receiver local oscillators, adjusting defective r.f. components, measuring large standing-wave ratios and measuring the Q of resonant cavities.

SPECIFICATION:—

Tuning range: 8,630 to 9,550 Mc/s (723/AB klystron). Frequency calibration by means of a pip provided by a reaction type cavity wavemeter. I.F. frequency: 20 Mc/s. Receiver band width: 50 kc/s. Receiver gain: 130 db. 4 i.f. stages. 3 video stages Sweep frequency variable from 10 to 20 c/s. Attenuation graduated from 0—100, with calibration factor of 1.0 db/div. above 10.

MANUALS

For the following receivers:—
AR88LD-D, AR77E, R107, Hallicrafters, SX24, SX28, S20R, S20, B2 Transmitter-Receiver, HQ120, HRO, Junior and Senior, **£1/7/6** each. Set of main dial, bandspread and name plate for AR88D, **£1/10/-** set of three.

MEGGER Insulation Testers

Eversheds Series I Megger Insulation Testers, 500V 40 megohms	£25	0	0
Eversheds Series I Megger Insulation Testers, 1,000V 100 megohms from	£27	10	0
Eversheds Series I Megger Insulation Tester, 1,000V 100 megohms, complete with decade box for resistance measurements, unused	£60	0	0
Eversheds Series II 500 V Megger Insulation Testers in leather case	£35	0	0
Eversheds Series III Megger Insulation Testers ("Wee" Megger), 500V	£12	10	0
Eversheds bridge Meggers, 500V.	£45	0	0

SULLIVAN Laboratory Variable Air Condensers

.. .. 0.0012 .. New **£25**

THOMSON-Varley Potential Divider

Manufactured by H. Tinsley. This is a precision potentiometer having three decades plus divided wire, total resistance 70,000 ohms; resolution 1/100,000 of total resistance. Built-in galvanometer appr. 1 microamp. F.S.D. Accuracy .01%. Unused **£25**

SYNTHETIC SAPPHIRE

- Styli or cutters for gramophone recording purposes.
- Wear-resisting faces for measuring machines, gauges, optical applications, and prisms.
- Low-loss windows for high power systems, wave guides, etc.
- Windows for infra-red transmission.

This sapphire, which is identical to the natural material in its basic chemical, physical and electrical properties, is produced with a considerably higher standard of purity and uniformity, and is available in larger pieces.
Write for leaflet.

SEI

SALFORD ELECTRICAL INSTRUMENTS LTD.
(COMPONENTS GROUP)
TIMES MILL · HEYWOOD · LANCASHIRE. *Tel. Heywood 6868*
London Sales Office: Tel. Temple Bar 4669
A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

THE BRITISH NATIONAL RADIO SCHOOL
ESTD. 1940

NOW IN OUR SEVENTEENTH YEAR AND STILL
NO B.N.R.S. STUDENT HAS EVER FAILED
to pass his examination(s) after completing our appropriate study course

A.M.Brit.I.R.E., CITY and GUILDS, and P.M.G. EXAMINATIONS and now
Another B.N.R.S. "FIRST"

MORSE TUITION. *RECEPTION* with L.P. Records.

***"SENDING"* monitored by telephone and tape recorder. A complete service.**

Our Principal will personally check your "sending" by telephone on his tape recorder and will return to you a morse inker copy of your "sending" with his criticism and advice.

Please write for full details.

PRINCIPAL,
BRITISH NATIONAL RADIO SCHOOL
66 ADDISCOMBE ROAD, CROYDON, SURREY
Tel. ADDiscombe 3341

INSULATED INSPECTION MIRROR

A one-piece steel handle securely soldered to a shell carries a 24 mm. diameter glass dental type mirror.
All the exterior is coated with a thick continuous layer of synthetic insulating compound.
The mirror can be used with convenience and safety for the inspection of switch gear, relays, etc.
No. 1195 either plane or magnifying mirror. List No. 168 illustrated and describes this and other dental types of inspection mirrors.

MANUFACTURED BY:—

GOWLLANDS LTD., MORLAND ROAD, CROYDON, SURREY
Obtainable from Small Tool or Scientific Instrument Dealers

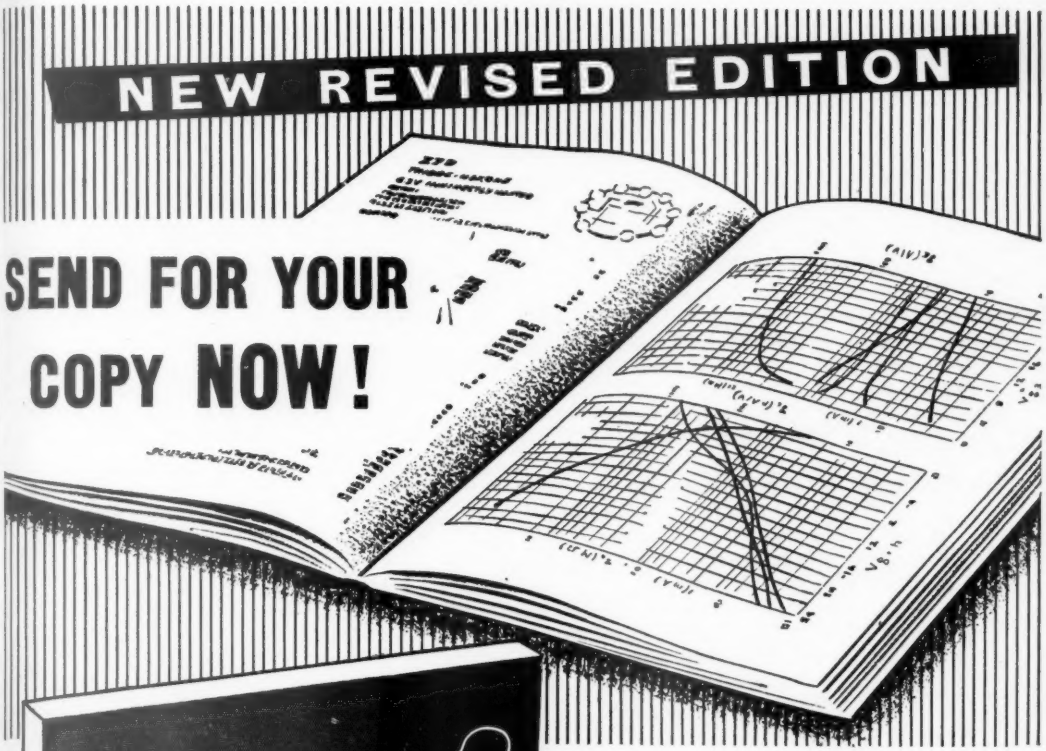
DEPENDABLE RADIO SUPPLIES LTD.
12a TOTTENHAM STREET, LONDON, W.1. *Phone LANgham 7391/2*
FOR
- **ROTARY TRANSFORMERS**
- **U.S.A. DYNAMOTORS**
- **CINE CAMERAS**
- **LOUD HAILERS**
- **SIEMENS HIGH SPEED RELAYS**
- **LONDEX RELAYS**
- **BLOWER MOTORS**
- **TAPE RECORDER MOTORS etc.**

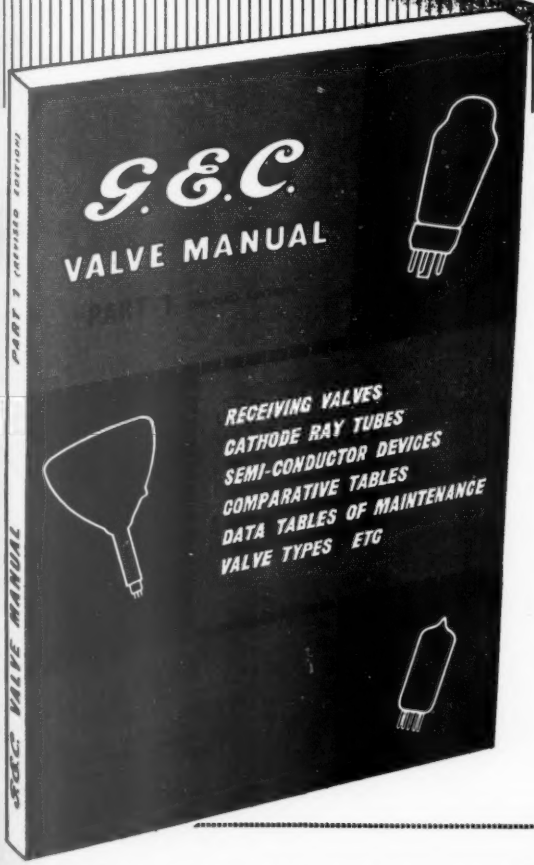
Your enquiries invited

Please see FEBRUARY and MARCH issues for full details and watch for MAY announcement

NEW REVISED EDITION

SEND FOR YOUR COPY NOW!





The G.E.C. Valve Manual

PART I

This manual is a guide for those engaged in the design or maintenance of broadcast receivers and electronic equipment. Characteristics, operating data and curves are given for valves and other electronic devices. There are over 200 pages of invaluable reference, including 28 pages of comprehensive comparative tables. Information on other devices includes cathode ray tubes, photo-electric cells, current and voltage regulator tubes, neon indicators, Geiger-Müller tubes, and semi-conductor devices. Data on obsolete valves is also included.

PRICE **7/6** plus 9d for post and packing from the G.E.C. Valve and Electronics Dept.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

SELENIUM RECTIFIERS

L.T. Types

2/6 v. ¾ a.h.w.	1/9
6/12 v. ½ a.h.w.	2/9

F.W. Bridge

6/12 v. 1 a. ..	4/11
6/12 v. 2 a. ..	9/9
6/12 v. 3 a. ..	11/9
6/12 v. 4 a. ..	14/9
6/12 v. 6 a. ..	19/9
6/12 v. 10 a.	25/9

H.T. Type H.W.

120 v. 40 mA.	3/9
250 v. 50 mA.	5/9
250 v. 80 mA.	7/9
250 v. 150 mA.	9/9
300 v. 250 mA.	12/11

BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50 c/s. Guaranteed 12 months

ASSEMBLED CHARGERS

6 v. 1 a.	19/9
6/12 v. 1 a.	27/9
6 v. 2 a.	29/9
6/12 v. 2 a.	38/9
6/12 v. 4 a.	56/9

Above ready for use with mains and output leads. Cases well ventilated and finished in stoved blue hammer. Carr. and packing. 3/6.

BATTERY CHARGER KITS

Consisting of Mains Transformer F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/6 extra.

6 v. or 12 v. 1 amp. ..	22/9
6 v. 2 amps	25/9
6 v. or 12 v. 2 amps. ..	31/6
6 v. or 12 v. 4 amps. ..	53/9

BATTERY CHARGER KIT Consisting of F.W. Bridge Rectifier 6/12 v. 5 a. Mains Trans. 0-9-15 v. 6 a. output, and ammeter. Only 49/9. Post 3/-.

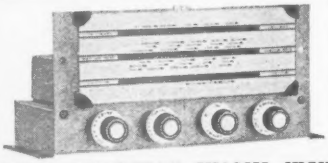
ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use with mains and output leads. Double Fused. Only **49/9** Carr. 3/6.

Assembled 6v. or 12v. 4 amps.

Fitted Ammeter and variable charge selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Well ventilated steel case with blue hammer finish. Ready for use with mains and output leads. Carr. 3/9. Or Deposit 30/- and four monthly payments 13/-. **75/-**



AM/FM RADIOGRAM CHASSIS, HIGH QUALITY. PUSH PULL. 6-8 WATTS OUTPUT

Current manufacture. 12 months' guarantee. For 200-250 v mains. Covers L and M. Wavebands plus F.M. Includes 8 latest type miniature B.V.A. valves. Only 22 gns. plus 7/6 carr. Or deposit £2/12/- and 9 monthly payments of £2/12/-. Guaranteed 12 months.

CO-AXIAL CABLE. 75 ohms, ½in., 8d. yard. Twin screened feeder 11d. yard.

ELECTROLYTICS (current production) Not Ex-Govt.

Tubular Types		Can Types	
8 mfd. 450 v.	1/9	16 μF 450 v.	2/9
8 mfd. 500 v.	2/6	16 mfd. 500 v.	3/9
16 μF 350 v.	1/11	32 μF 350 v.	2/11
16 μF 450 v.	2/9	32 mfd. 450 v.	4/9
16 μF 500 v.	3/9	100 mfd. 450 v.	4/9
8-16 μF 500 v.	4/11	8-8 μF 450 v.	2/11
25 μF 25 v.	1/3	8-16 μF 450 v.	3/11
50 μF 12 v.	1/3	16-16 μF 450 v.	3/11
50 mfd. 25 v.	1/9	32-32 μF 350 v.	4/9
50 μF 50 v.	1/9	32-32 μF 450 v.	5/9
100 mfd. 12 v.	1/9	100-100 mfd. 350 v.	5/9
100 mfd. 25 v.	2/3	64-120 mfd. 350 v.	7/6
3,000 mfd. 6 v.	3/9	100-200 mfd. 275 v.	6/11
6,000 mfd. 6 v.	3/11		

Many others in stock.

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

EX GOVT. STEP UP/STEP DOWN TRANSFORMERS. Double wound 80/100 watts. 10-0-100-200-220-240 v. to 5-0-75-115-125-135 v. or Reverse. Only 11/9 plus 2/9 post 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or Reverse. 300 watts, 35/9, plus 7/6 carr.

EX GOVT. METAL BLOCK PAPER CONDENSERS

4 mfd. 1,000 v... 3/9 8 mfd. 500 v... 4/6
10 mfd. 500 v. 3/9

THE SKY FOUR T.R.F. RECEIVER

A design of a 3 valve 200-250 v. A.C. Mains L. & M. wave T.R.F. receiver with selenium rectifier. For inclusion in cabinet illustrated or walnut veneered type. It employs valves 6K7, SP61, 6F6G, and is specially designed for simplicity in wiring. Sensitivity and quality is well up to standard. Point-to-point wiring diagrams, instructions and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including cabinet. Available in brown or cream bakelite, or veneered walnut.

EX GOVT. VIBRATOR UNITS. 12 v. input 280 v. output. Suitable for car radio etc., 16/6.

VIBRATORS. Oak and Wearite. Synchronous 7 pin 2 v. 7/9, 6 v. 8/9.

EX. GOVT. 50 WATT AMPLIFIERS. Brand new. For 200-250 v. 50 c.p.s A.C. mains. Designed for speech only but with suitable pre-amp, could be used with Gram. or Radio. Valves included. Four 6L6s used for output. Complete with hand microphone with good length of lead. Unused in original transit cases. Only 9 gns. Ready for use. Carr. 15/-.

RE-ENTRANT SPEAKERS. Tannoy 8 watt, 7.5 ohms suitable for above, 25/- each.

EX GOVT. MAINS TRANSFORMERS

All 200-250 v. 50 c/s. input.

250-0-250 v. 60 mA., 6.3 v. 3 a., 6.3 v. 1 a. Potted 4½-3½-3in.	11/9
Pr. 0-110-200-230-250 v., 275-0-275 v. 100 mA., 6.3 v. 7 a., 5 v. 3 a.	21/9
230-0-230 v. 80 mA., 12.6 v. 1.5 a. 5 v. 2 a.	11/9
250-0-250 v. 150 mA. 5 v. 3 a.	16/9
350-0-350 v. 160 mA. 6.3 v 5 a. 5 v. 3 a.	27/9
400-0-400 v. 250 mA. 5 v. 2 a., 5 v. 2 a.	18/9
450-0-450 v. 150 mA. 6.3 v. 5 a., 6.3 v. 1 a., 5 v. 3 a.	29/9
450-0-450 v. 250 mA. 6.3 v. 3 a., 6.3 v. 1 a., 5 v. 6 a.	49/9
12.5 v. 3 a., 5 v. 3 a.	12/9

MANUFACTURERS' SURPLUS TRANSFORMERS. Primary 230-250 v. Drop through type 325-0-325 v 100 mA., 6.3 v. 2.5 a., 5 v. 2 a. 17/9. Post 1/9.

EX GOVT. SMOOTHING CHOKES

300 mA., 20 H., 150 ohms	19/6
250 mA., 5 H., 50 ohms	12/9
150 mA., 10 H., 50 ohms	10/11
120 mA., 12 H., 100 ohms	9/9
100 mA., 10 H., 100 ohms	6/9
100 mA., 5 H., 100 ohms, tropicalised..	3/11
50 mA., 50 H., 1,000 ohms	6/9

EX GOVT. CASES. Well ventilated, black crackle finished, undrilled cover. Size 14 × 10 × 8½in. high. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 post. Size 13½in. × 8in. × 6½in. with undrilled perforated cover finished in stoved grey enamel, 7/9, plus 2/9 post.

SPECIAL OFFERS. Small 2 gangs .005 mfd., 4/9. Electrolytics 32-32-32 mfd. 250 v., 2/9 each or in lots of six, 2/3 each.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all dry battery eliminator. Size 5½ × 4½ × 2in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s. is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types. Complete kit with diagram. 39/9 or ready for use 46/9.

Type BM2. Size 8 × 5½ × 2½in. Supplies 120 v., 90 v., and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed **THEREBY COMPLETELY REPLACING BOTH H.T. BATTERIES AND L.T. 2v. ACCUMULATORS** when connected to A.C. mains supply 200-250 v. 50 c/s. SUITABLE FOR ALL BATTERY RECEIVERS normally using 2 v. accumulator. Complete kit with diagrams and instructions, 49/9, or ready for use, 59/6.

JUNCTION TRANSISTORS For R.F. 17/6. A.F. 7/6.

MINIATURE MOTORS. 24/28 v. D.C. A.C. Size only 2½ × 1½in. Spindle 1½in. long, ¼in. diam. Made by Hoover Ltd., Canada. Price only 9/9.

M.E. SPEAKERS. 2-3 ohms R.A. 8in. Field 600 ohms., 11/9.

R.S.C. TRANSFORMERS

FULLY GUARANTEED. INTERLEAVED AND IMPREGNATED.

MAINS TRANSFORMERS

Primaries 200-230-250 v. 50 c/s.

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a.	17/6
350-0-350 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	19/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion	31/-
300-0-300 v. 100 mA., 6.3 v. 4 a. 5 v. 3 a.	25/9
350-0-350 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	25/9
300-0-300 v. 130 mA., 6.3 v. 4 a., c.t., 6.3 v. 1 a., suitable for Mullard 510 Amplifier	33/9
375-0-375 v. 150 mA., 6.3 v. 4 a., 5 v. 2 a.	29/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
425-0-425 v. 200 mA., 6.3 v. 4 a., c.t., 6.3 v. 4 a., c.t., 5 v. 3 a., suitable Williamson Amplifier, etc.	49/9

TOP SHROUDED DROP-THROUGH TYPE

260-0-260 v. 70 mA., 6.3 v. 2 a., 5 v., 2 a.	16/9
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a	18/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	22/9
300-0-300 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
350-0-350 v. 100 mA. 6.3 v. 4 a., 5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	29/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.

120 v. 40 mA., 5-0-5 v. 1 a.	14/9
90 v. 15 mA., 6-0-6 v. 250 mA.	9/11

FILAMENT TRANSFORMERS

Primaries 200-250 v. 50 c/s.

6.3 v. 1.5 a.	5/9	6.3 v. 3 a.	8/11
6.3 v. 2 a.	7/6	6.3 v. 6 a.	17/6
0-4-6.3 v. 2 a. ..	7/9	12 v. 3 a. or	
12 v. 1 a.	7/9	25 v. 1.5 a. ..	17/6

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries:
0-9-15 v. 1½ a., 11/9; 0-9-15 v. 3 a., 16/9; 0-9-15 v. 5 a., 19/9; 0-9-15 v. 6 a., 23/9.

OUTPUT TRANSFORMERS

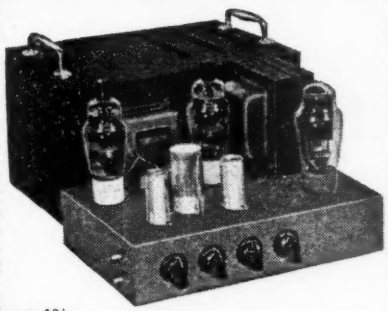
Midget Battery Pentode 66:1 for 3S4, etc.	3/6
Small Pentode 5,000 Ω to 3 Ω	3/9
Standard Pentode, 5,000 Ω to 3 Ω	4/6
Standard Pentode, 8,000 Ω to 3 Ω	4/9
Push-pull 8 watts 6V6 to 5 ohms	8/9
Push-pull 10-12 watts 6V6 to 3 Ω or 15 Ω	15/9
Push-pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω	16/9
Push-pull EL84 to 3 or 15 ohms	16/9
Push-pull 15-18 watts, sectionally wound, 6L6, KT66, etc., to 3 or 15 ohms	21/9
Push-pull 20 watt high-quality sectionally wound, 6L6, KT66, etc. to 3 or 15 Ω	47/9

SMOOTHING CHOKES

250 mA., 5 H., 100 ohms	11/9
150 mA., 7-10 H., 250 ohms	11/9
100 mA., 10 H., 200 ohms	8/9
80 mA., 10 H., 350 ohms	5/6
60 mA., 10 H., 400 ohms	4/11
1 amp. 0.5 ohm. L.T. type	6/6

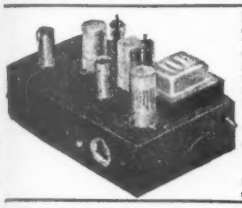
R.S.C. A10 ULTRA LINEAR 30 WATT AMPLIFIER

HIGH FIDELITY PUSH-PULL UNIT EMPLOYING SIX VALVES. EF86, EF86, ECC83, 807, 807, GZ34. Tone Control Pre-amp stages are incorporated. Sensitivity is extremely high. Only 12 millivolts minimum input is required for full output. **THIS ENSURES THE SUITABILITY OF ANY TYPE OR MAKE OF MICROPHONE OR PICK-UP.** Separate Bass and Treble controls give both "lift" and "cut" with ample tone correction for long playing records. An extra input with associated vol. control is provided so that two separate inputs such as "mike" and gram., etc., etc., can be simultaneously applied for mixing purposes. **AN OUTPUT SOCKET WITH PLUG IS INCLUDED FOR SUPPLY OF 300 v. 20 mA. and 6.3 v. 1.5 a. FOR A RADIO FEEDER UNIT.** Price in kit form with easy-to-follow wiring diagrams. Cover as illustrated 18/9 extra. Only **£10/19/6** carr. 10/- Or Factory built with 12 months' guarantee **£13/13/-.** **TERMS ON ASSEMBLED UNITS. DEPOSIT 36/-** and 9 monthly payments of 31/-.



Type 807 output valves are used with High Quality Sectionally wound output transformer specially designed for Ultra Linear operation. Negative feedback of 20 D.B. in main loop. **CERTIFIED PERFORMANCE FIGURES ARE EQUAL TO MOST EXPENSIVE UNITS AVAILABLE.** Frequency response ± 3 D.B., 30-20,000 c/cs., Tone Controls ± 12 D.B. at 50 c/cs., + 12 D.B. to − 6 D.B. at 12,000 c/cs., Hum and noise 70 D.B. down. Good quality reliable components used. Chassis finish blue hammer. Overall size 12 × 9 × 9in. approx. Power consumption 150 watts. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. **EQUALLY SUITABLE FOR THE CONNOISSEUR OR FOR LARGE HALLS, CLUBS, or OUTSIDE FUNCTIONS. IDEAL FOR USE WITH MUSICAL INSTRUMENTS SUCH AS STRING BASS, ELECTRONIC ORGAN, GUITAR, etc. FOR DANCE BANDS, GARRISON THEATRES, etc. etc. We can supply Microphones, Speakers, etc., at keen cash prices or on terms with amplifiers.**

EXPORT ENQUIRIES INVITED



LINEAR LT/45 HIGH QUALITY TAPE DECK AMPLIFIER COMPLETE with POWER PACK and 050. STAGE. Suitable for Collaro, Lane, Truvox. Aspden Brennell, etc., etc. State make of Deck when ordering. Chassis size 12-7-3in Overall size 12-7-6½in. For 200-250 v 50 c/cs. A.C. mains. Output for standard 2-3 ohm speaker. Only 15 millivolts input required for full recording. Only 2 millivolts minimum output required from recording head. Magic Eye recording level indicator. Provision for feeding P.A. amplifier. Negative feed-back equalisation. Linear frequency response ± 3 D.B 50-11,000 c/cs Facilities for recordings at 15in., 7½in or 3¾in. per second Automatic equalisation at the turn of a knob. When switching from record to playback position automatic demagnetisation of heads is assured. Separate gain and output controls. Valves type EOC83, ECC83 EL84, EZ80, EM34. Output 4 watts. Unit supplied with maker's 12 months' guarantee. We know of no other make which represents the same exceptional value. Leaflet 6d.

12 GNS. Ready for use Carr. 7/6.

COLLARO JUNIOR 4 SPEED RECORD PLAYER with separate pick-up having dual point sapphire stylus. Brand new, cartoned. For 200-250 v. A.C. mains only **£4/12/6.** Carr. 3/6.

L&S MINIATURE 3 WATT GRAM. AMPLIFIER for 200-250 v. 50 c.p.s. A.C. Mains. Overall size only 6½ × 4½ × 3½in. Fitted vol. and Tone Control with mains switch. Designed for use with any kind of single player or record changing unit. Output for 2-3 ohms speaker. Guaranteed 12 months. Only **55/9.**

R.S.C. A5 4-5 WATT HIGH GAIN AMPLIFIER

A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble controls are provided. These give full long playing record equalisation. Hum level is negligible being 71 D.B. down. 15 D.B. of negative feedback is used. H.T. of 300 v. 26 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 cys. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with the blue hammer finish, and point-to-point wiring diagrams and instructions. Exceptional value at only **£4/15/-**, or assembled ready for use **25/-** extra, plus 3/6 carriage. Or Deposit **22/-** and five monthly payments of **22/-** for assembled unit.

R.S.C. A7 3-4 WATT QUALITY AMPLIFIER

A highly sensitive 4-valve amplifier using negative feedback and having an excellent frequency response. Pre-amplifier and Tone Control stages are incorporated with separate Bass and Treble controls giving full tone compensation for long playing records. Suitable for any kind of pick-up including latest high fidelity types. H.T of 250 v. 20 mA and L.T. 6.3 v. 1 a. available for supply of Radio Feeder Unit, etc. ONLY 40 millivolts input required for full output. Fully isolated chassis with baseplate. For A.C. mains 200-250 v. 50 cycles. Output for 2-3 ohm speaker. Complete kit of parts with point-to-point wiring diagrams and instructions. Only **£3/15/-**, carr. 3/6 or factory built 22/6 extra.

SENSATIONAL OFFER

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGER

A precision manufactured unit with finger tip control. Pick-up fitted with dual sapphire tipped stylus. A very compact changer with attractive duo-tone finish. For A.C. mains 110—250v. Brand new, cartoned. We offer this de-luxe player at only **£3/19/6.** *Post 3/6.*

COLLARO 4-SPEED AUTO-CHANGERS

With studio pick-up with turnover head. BRAND NEW. Cartoned, latest model. For 200-250 v. A.C. mains. Very limited number. Conquest **£8/19/6.** Continental **9 Gns.** Carr. 5/6.

COLLARO RC54 3 SPEED AUTO-CHANGER

As above unit but for normal 3-speed requirements. Brand new cartoned but for 110 v. 50 c.p.s. A.C. mains. So that the unit can be operated from normal 200-250 v. A.C. mains we are supplying free with every changer a suitable auto-transformer with input and output voltages clearly marked. Limited number only. **7 Gns.** Carr. 5/6.

LINEAR L&S MINIATURE 4/5 W. QUALITY AMPLIFIER. Suitable for use with Garrard R.S.R. or any other record playing unit and most microphones. Total negative feedback 12 D.B. Separate Bass and Treble controls. For A.C. mains input of 200-250 v. 50 c.p.s. Output for 2/3 ohm speaker. Three miniature Mullard valves used. Size only 6 × 5 × 5½in. high. Chassis fully isolated from mains. Guaranteed 12 months. Only **£5/19/6.** Or Deposit 22/-, and five monthly payments of **22/-.** Send S.A.E. for leaflet.

PLESSEY DUAL CONCENTRIC 12in. P.M. SPEAKERS

(15 ohms), consisting of a high quality 12in. speaker of orthodox design supporting a small elliptical speaker ready wired with choke and condensers to act as tweeter. This high fidelity unit is highly recommended for use with our A11 or any similar amplifier. Rating is **10 watts.** Gauss 12,000 lines. Price only **£5/17/6.** Or Deposit 13/- and nine monthly payments of 13/-.

A11 ULTRA LINEAR 12-14 WATT AMPLIFIER

NEW 1958 DESIGN HIGH-FIDELITY PUSH-PULL AMPLIFIER WITH "BUILT-IN" TONE CONTROL PRE-AMP. STAGES

Two input sockets with associated controls allow mixing of "mike" and gram. as in A10. High sensitivity. Includes 5 valves, ECC83 ECC83, EL84 EL84, 5Y3, High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut" Frequency response ±3 DB 30-30,000 c/cs. Six negative feedback loops Hum level 60 DB down ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 m.a. and 6.3 v. 1.5. a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied.

Only **8 GNS.** Carr. 10/-. or factory built **45/-** extra. If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 25/6** and nine monthly payments of **25/6.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets, Speakers, Microphones etc., with cash and credit terms.

LINEAR "DIATONIC" 10-WATT HIGH FIDELITY AMPLIFIER. Incorporating pre-amp For A.C. mains input 200-230-250 v. 50 c.p.s. A compact attractively finished unit with two separately controlled inputs and outputs for 3 and 15 ohms speakers. Separate Bass and Treble controls. Five latest type miniature Mullard valves. Only **12 Gns.** Send S.A.E. for leaflet and credit terms.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS. HF1012, 10 watts 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. **£4/10/9.** Please state whether 3 ohm or 15 ohm required.

P.M. SPEAKERS. 2-3 ohm 5in. Goodmans **17/9.** 7 × 4in. Elliptical **19/9.** 6½in. Rola, **19/9,** 8in. Rola, **19/9,** 8in. Goodmans **21/9.** 10in. R.A. **28/9.** 12in. Plessey **29/11.** 12in. Plessey 3 ohms, 10 watts. 12,000 lines **59/6.**

SUPERHET RADIO FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). A Triode Heptode F/changer is used. Pentode I F. and double Diode Second Detector, delayed A.V.C. is arranged so that A.V.C. distortion is avoided. The W Ch. 8w. incorporates Gram. position. Controls are Tuning, W. Ch., and Vol. Output will load most Amplifiers requiring 500 mV. input depending on Ae location. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Send S.A.E. for illustrated leaflet. Total building cost is **£4/15/-.** Point-to-point wiring diagrams and instructions. **2/6.**

Radio Supply Co. (LEEDS) LTD.

32 THE CALLS. — LEEDS, 2.

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/9 extra on all orders under £2. 2/9 extra under £5 unless carriage charge stated. Full Price List 6d. Trade List 5d. Open to Callers: 9 a.m. to 5.30. p.m. Saturday until 1 p.m. S.A.E. please with all enquiries.

TRANSFORMERS 230-250 volts 50 c/s.

Heater 6.3 v., 1.5 a., **6/6** plus 1/- carr. **Miniature mains** 230 v. at 40 mA. and 6.3 v. at 1.5 a., **12/6** plus 1/- carr. **Charging** 9 v. and 17 v. at 3 a., **15/6** p.p. **Mains isolating**, 250 v./220 v. or 250 v./110-0-110 v. out OR double wound auto 250 v. in, 110 v. out, **5/-** carr. 1/6. **Heavy duty mains changing** (Admiralty Pattern) 230/100-110-130 v. at conservatively rated 440 mA. Primary screened from secondary. Totally enclosed in 7 × 6 × 8in. black steel case—terminals inside lid. **£1** p.p.

OUTPUT TRANSFORMERS

Pleasey standard miniature output transformer, ratio 45 : 1 and 55 : 1, **4/6** p.p. Please state ratio required.

FULL-WAVE CHARGING RECTIFIERS—12 v. 4 a., **14/-** p.p. 24 v. 1.5 a. **12/6** p.p.

LOUDSPEAKERS

Tannoy waterproof external 8 watt unit 7½ ohm impedance. Complete with matching transformer. Brand new **£1** plus 3/6 carr.

HEADPHONES

Low resistance balanced armature, **8/6** p.p. High resistance balanced armature. **£1** p.p.

MICROPHONES

Acos crystal mic inserts. **4/6** p.p. American throat microphones type T.S.300 including socket **3/-** p.p. Aircrew type electro magnetic microphones with switch **2/-** p.p. Carbon mic in black crackle case **12/6** p.p.

RELAYS

Carpenter type 8C9 polarized 1685 ohms each coil. Current 100-200μA., **22/6** p.p. Sensitive U.S. type single pole changeover relay. Heavy duty **12/6** p.p.

R.F. UNIT

Freq.: 200 Mc/s. With 3 956 valves. Size 8 × 3 × 4in. **15/-** p.p.

CERAMIC STUD SWITCH

6 pole 3 way. Square type switch bar. **3/6** p.p.

ELECTROLYTICS

8+8 mfd. 450 vW., **3/6**. 16+16 mfd. 450 vW. **4/3**. 32+32 mfd. 350 vW., **4/6**. 16 mfd. 450 vW., **3/-**. All post paid.

MINIATURE I.F. STRIP—9.72 Mc/s

Complete and unused with circuit, less valves—2 EF 92, 3 EF 91, 1 EB 91. **12/-** p.p.

MULTI-RANGE TEST METER

Ranges 0-1.5 v., 0-3 v.; 0-60 mA; 0-500 and 0-5000 ohms. Easily read open scale. Simply extended to provide useful pocket fault finder. Size 2½ × 3½ × 3½in. Brand new, **8/6**. Carr 1/6

AERIAL MAST SECTION

3ft. long × 1in. dia., copper plated, screwed ends. Make up to any length. **3/-** per length, p.p.

H.R.O. WINDOW DIAL

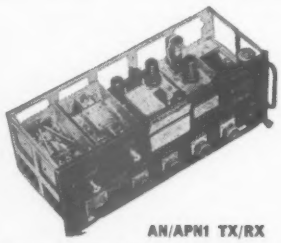
Brand new and boxed, **18/-** p.p.

A.R.88 KNOB

1½in. dia. (middle size) **3/-** each, p.p.

APN1 TRANSDUCER

The heart of the "W.W." TV wobbulator (described on page 252 of June 1956 issue). Brand new **7/6** p.p.



AN/APN1 TX/RX

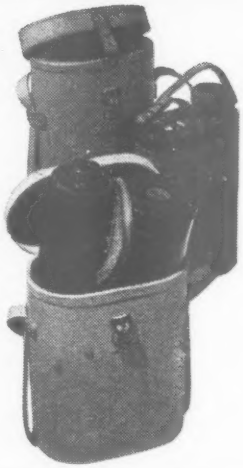
Frequency modulated by moving coil transducer—heart of famous W.W. Wobbulator. Freq. Receiver, 400-450 Mc/s. Transmitter 418-462 Mc/s. Easily converted for radio control or 70 cms. Complete with 14 valves, 4-12SH7 3-12SJ7, 2-12HG, 2-955, 2-9004 and 1-VR150. Contains a host of first class components including relays and close tolerance resistors. Brand new, at less than breakdown price.

Carr. 7/6. **£1.10.0**

PROOPS *Brothers Ltd*

DEPT. 'W'

The Walk-around Shop



INFRA-RED VIEWING EQUIPMENT

See in the dark with equipment specially developed for night-driving, reconnaissance, sniping, etc.

MONOCULAR £1 p.p.

Sealed unit incorporating push button operated Zamboni pile. Focusing eyepiece. Brand new in stout hide (binocular type) case.

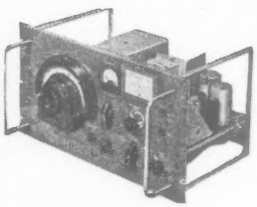
MONOCULAR £1/10/- p.p.

Larger, all plastic model, with bigger caesium cell. Brand new in superb hide shoulder strap carrying case.

VIEWING LAMP 17/6 p.p.

Weatherproof car spotlamp providing a powerful source of infra-red rays through easily removable filter. Takes standard 12 v. bulb. Swivelling single-point bumper fitting. Brand new.

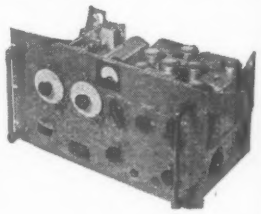
RECEIVERS



R.1132A

Frequency 95-126 Mc/s. 11 Valve Superhet. RF. Amp. VR.65, Frequency Changer VR.65, Local Oscillator VR.66, Stabilizer VS.70, I.F. Amplifiers VR.53's, B.F.O. VR.53, Detector VR.54, A.F. Amplifier VR.57, Output VR.37 Switched A.G.C., Variable B.F.O. Standard Rack Mounting, easily converted to receive Wrotham without alteration to wiring. Circuit diagram and conversion instructions supplied. Size 19 × 10 × 10in.

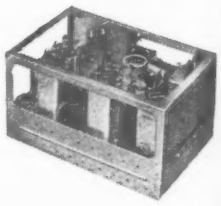
Carriage 10/-. **£3.7.6**



R.1392

95-150 Mc/s (2-3 Metres). 15 Valve Superhet. 1st and 2nd RF. EF54, 1st Local Oscillator SP61, 2 Oscillator Multipliers EF54 3 IF's EF.39, AGC.6Q7, Output 6J5, Muting EA.50, Noise Limiter EA.50, BFO.6J7, Mixer EF.54, Detector 6Q7. Normally Crystal Controlled, but can be tuned over 95 to 150 Mc/s. Power supply required = 240-250 volts at 80 mA. 6.3 volts at 4a. Standard Rack Mounting, 19 × 10in. Complete with valves and circuit diagram. Air Tested.

Carr. 10/-. **£6.19.6**



TRANSMITTER/RECEIVER No. 19 Mk. II

Frequency coverage 2 to 8 Mc/s for R/T MCW.CW. Superhet Receiver 465 Kc/s IF's BFO etc. Receiver line-up; 6K7 RF; 6K8 Mixer; two 6K7 IF's; 6B8 Det. Transmitter line-up 6K8 Mixer; VFO EF50 buffer; AGC EB34; 807 P/A. This unit incorporates a TX/RX 229 at 241 Mc/s with a local range of 1 mile. Valve line-up: CV6, two 6K7's and 6V6. Also intercom. set. two valve AF amplifier 6K7 and 6V6. American manufacture. Complete with valves in as new condition.

Carr. 10/-. **£3.5.0**

ARR3

13 Valve 60 Mc/s FM Receiver. Conversion to B.B.C. FM Transmissions simple. 1st and 2nd RF, Mixer, Osc. 1st, 2nd and 3rd IF's all 12SG7's. Limiter and Detector 12H6. 1st AF 12SQ7.n O/P 12A6. AFC. 2 × 12SH7's, Magic eye 12U5G. With circuit diagram.

Carr. 7/6. **£6.0.0**

RECEIVER UNIT EX.1143A

Suitable for conversion to 2 Metres or Wrotham FM transmissions. Valve line-up: Four EF.50's; One EL.32, Two EF 39's; One EBC.33; One EA.50. Circuit diagram supplied with each unit. Complete with valves.

Carr. 3/6. **£1.5.0**

52 Tottenham Court Road, London, W.1

SHOP, HEAD OFFICE AND MAIL ORDER ENQUIRIES } **Telephone LANgham 0141**

Shop hours 9 a.m. to 6 p.m.—Thurs. 9 a.m. to 1 p.m. **Open all day SATURDAY**

Carriage prices quoted apply only to England and Wales

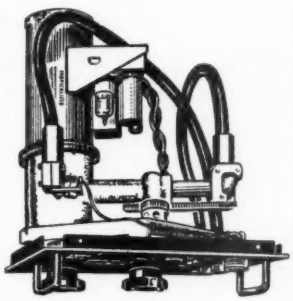
TEST GEAR

TS184 A/AP

A further large release enables us to offer this precision 70 cm. test gear for only 57/6 carriage paid. RESONANT CAVITY WAVEMETER calibrated 400-430 Mc/s. Tuning stops adjustable to any 30 Mc/s band within the 400 to 470 Mc/s coverage.

Calibrated scale rack and pinion drive piston input attenuator and alternative fixed coupling loop input provides facilities for use as a signal generator. Plug-in "Telescopic Probe Antenna." 6J6 detector and Monitor amplifier, 2-600 ohm phone jacks for modulated signals. Panel output terminals for metering 6J6 output current. Power required = 6 volts at 300 mA. and 30 volts at 0.5 mA.

24-page booklet supplied with each unit giving comprehensive circuit description, diagrams and suggested modifications, etc.



SIGNAL GENERATOR 600-1,200 Mc/s

TS.281. 230 volt 50 c/s Mains. Case 14 × 14 × 12in. Fitted with 11in. dia. Parabolic Aerial and Perspex Radome. 2 × CV.90 (Mazda Osram E.1368). Wide band oscillator in Precision Cavity. EF50 modulator and 6X5 Rectifier. Suitable for 23 cm. and latest B.B.C. Television (654 Mc/s). Directly calibrated dial. Brand new. Carriage paid. **£22.10.0**

SIGNAL GENERATOR AND WAVEMETER Type W 1649

In copper lined case. Freq. Sig. Gen. 140-240 Mc/s (tolerance 0.5 Mc/s). Wavemeter 150-235 Mc/s (tolerance 0.2 Mc/s). Complete with valves 4.VR91 and 1 VR135 and 5 Mc/s crystal. Requires 6.3 v. and 120 v. power supply.

SIGNAL GENERATOR Type 52A

Complete in transit case with four calibration charts, leads, dummy antenna and circuit. Spec.: Input 230 v. 50 c/s. Freq. 6-52 Mc/s in Four ranges. Coarse and fine attenuators. Int. and Ext. Mod. Output, 0.5 uV to 100 mV. Impedance 70 and 100 ohms. Brand new £10. Carr. 10/-. Complete photostat handbook supplied on request for 4/6 extra.

RADIO ALTIMETER

5 mA. panel mounting with 3in. dia. 8in. circular scale Beats for sensitive multimeter Brand new, boxed, 7/6 p.p.

VALVE BARGAINS. 6K7, 3/- p.p. 6B8G, 3/- p.p. IN21A Silicon crystal 1/6 p.p.

GYRO UNIT AND INVERTER

Can be used as 12 v. D.C. motor for models; ideal also for experimentation and gyro demonstration purposes. Inverter: 12 v. D.C. input, 3-phase 190 cycle output. Size 4 × 4 × 3in. Gyro unit: operates on 3-phase output from inverter. Peak speed 11,400 r.p.m. Caged. Precision made equipment. 12/6 per pair. Carr. 3/-.

ANTENNA RELAY UNIT

Contains 2½in. panel mounting 2 mA. meter with separate thermocouple for measuring R.F., and changeover relay. In metal case 3½ × 4½ × 3½in. with ceramic stand-off terminals. 12/6 p.p.

BOLT CROPPERS

9in. long, extremely powerful, 2/6 p.p. Folding type 18in. long—will cut through ¼ bolt or cable, 7/6 p.p.

DYNAMOTOR

(U.S.A. Manufacture) 28 volts input, 330 volts 170 mA output. 3½in. dia. × 4in. long, mounted on base containing smoothing choke, condenser, etc.; black crackle finish. New and boxed. Price 17/6 p.p.

CO-AXIAL ADAPTERS

British to American or American to British co-axial adapters. Plug or socket fittings, 1/6 p.p.

MORSE KEY

Plastic moulded base. Size 3½ × 1½in., 2/6 p.p.

CONNECTOR BLOCKS

12 way "chocolate block" connectors. 3 for 6/6 p.p.

POCKET MARCHING COMPASS

In black plastic case with sighting reflector inside lid and automatic pointer lock. Luminous dial, pointer and sighting lines. Brand new with instructions, 12/6. Carr. 1/-.

TANK PERISCOPES

American type, 7/6 p.p.

SIGNAL LAMPS

24 v. Sealed Beam Units. 16/6 p.p.

ASTRO COMPASSES

Brand new in transit case, 23/- p.p.

DRIFT SIGHT Mk. 4A

13in. long × 1½in. dia. In wooden case, 12/6 p.p.

GROUND POSITION INDICATORS

Contains 24 v. motor and follower motors, large quantity of gearing, etc. 35/- p.p.

NAVIGATIONAL RULES

Scaled for Nautical miles, Metres, Feet. A fine plastic straight edge. 5 for 6/- p.p.

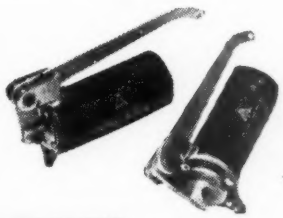
STOP PRESS

BARGAIN PRICE TABLE-TOP TRANSMITTER

No. 36 SENDER

Get on the air in 5 minutes flat with this complete 10-60 Mc/s 50 watt transmitting station. In two units, each housed in handsome oak cabinet with removable front panel. Power supply: 100/110, 200/250 volts, 40-60 cycles. *R.F. Unit :* Contains Master Oscillator (with or without Xtal control) Frequency Doubler and Power Amplifier. *Power Unit :* Contains Power Pack, Speech Amplifier and Modulator. Full details on request. In excellent condition and complete with all connecting cables.

£12.10.0 Carriage 30/-.



12 VOLT SOLENOID

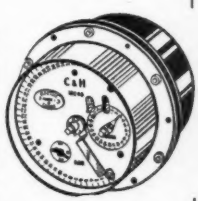
Powerful solenoid with lever mechanism giving a mechanical advantage of approx. 4 : 1 (¼in. travel = 3¼in. arm). Consumption 350 mA. Ideal for remote controls, model railways and mechanical indicators. Bargain offer 3 for 10/- p.p.

ROOM THERMOSTATS

By famous manufacturer. Voltage 0/250 v., maximum current 15a. Temperature control range 50°F to 80°F. Contemporary design in cream hammer finish, complete with wall fixing plate and full installation instructions. Brand new 15/-. Carr. 2/-.

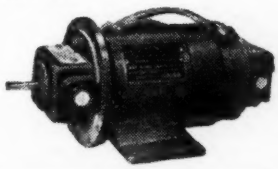
ELECTRIC TIME SWITCH

6 v. battery driven precision clock. Current negligible. Can be set to operate at any period between 15 minutes and 44 days. Ideal for automatic "lighting-up" of parked cars, etc. and many other uses. Brand new in plastic case. 12/6 p.p.



VELODYNE REVERSING MOTOR-GENERATORS TYPE 74

Motor Armature 5a, Field 80 mA. Generator Armature 56 v. D.C., Field 24 v. D.C. Size 8 × 3½in., ¼in. dia. spindle. £1/15/- p.p.



CLYNE RADIO LTD.

162, HOLLOWAY ROAD, LONDON, N.7

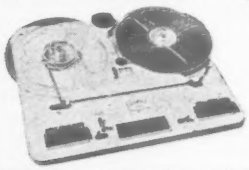
NORth 6295/6/7
ALSO AT:— 18, TOTTENHAM COURT ROAD, LONDON, W.1
MUSeum 5929/0095
(50 yards only from Tottenham Court Road Tube)
All post orders please to: 162, HOLLOWAY ROAD, LONDON, N.7

DULCI

DULCI H.3 A.M./FM Chassis (6 valve) Covering Long, Medium and F.M. bands. Mos. at. active dial in RED and GOLD on BLACK background £20/17/- plus 5/- c. & p.
DULCI H.4 PUSH-PULL AM/FM chassis £29/3/10 plus 5/- p. & p.
All Dulci products available ex stock. Illustrated leaflets and H.P. terms available.
Demonstrating at both branches.

SPEAKERS & ENCLOSURES
Full range in stock by WHARFEDALE W.B., T.S.L., etc.
Your enquiries welcomed.

AT LAST!
LIMITED STOCKS ONLY
The Very Latest
COLLARO MK. IV TAPE TRANSCRIPTOR



SUBJECT TO BEING UNSOLD, £22. plus 7/6 C. & P. H.P. or CREDIT SALE TERMS AVAILABLE.
The **COLLARO** Pre-Amplifier and Power Pack for use with the above deck is also available in limited quantity at **£21**, plus 3/6 P. & P.

VALVES. We have perhaps the most up-to-date valve stocks in the trade. A stamp will bring complete list of brand new imported valve types, fully guaranteed. F.T. paid. Also all usual surplus types available such as 6V6GT, etc.

SPECIAL OFFER TRANSFORMERS AND CHOKES. These are beautifully made, potted transformers and chokes by a well-known manufacturer, that will put the "finishing touch" to any equipment with which they are used. All are absolutely brand new.

MAINS TRANSFORMERS:
(A) PRIMARY: 230 v. SECONDARY: 290-0-290 v. 150 mA. 2 v. 1.4 amp. 6.3 v. tapped 4.16 v. 9 amp. 4.12 v. 4 amp. 5 v. 2 amp. Size 5½in. × 4½in. × 5½in. high. PRICE **45/-**.
(B) PRIMARY: 110, 200, 230, 250 v. SECONDARY: 350-0-350 v. 130 mA. 2 v. 1.4 amp. 6.3 v. tapped 4.16 v. 9 amp. 4.12 v. 4 amp. 4 v. 2.2 amp. Size 4½in. × 5½in. × 5½in. high. PRICE **45/-**.
(C) PRIMARY: 200, 230, 250 v. SECONDARY: 320-0-320 v. 180 mA. 4 v. 2.2 amp. 4 v. 6.2 amp. Size: 5½in. × 4½in. × 5½in. high. PRICE **20/-**.
(D) PRIMARY: 200, 230, 250 v. SECONDARY: 290-0-290 v 200 mA. 4 v. 2.2 amp. 6.3 v. tapped 4.2 v. 6.2 amp. Size 5½in. × 4½in. × 5½in. high. PRICE **35/-**.
(E) PRIMARY: 110, 200, 230, 250 v. SECONDARY: 330-0-330 v. 100 mA. 4 v. 1.4 amp. 4 v. 6 amp. Size: 4½in. × 3½in. × 3½in. high. PRICE **17/6**.
(F) PRIMARY: 200, 220, 230, 250 v. SECONDARY: 6 v. 6 amp. 2 v. 4 amp. 6 v. 3 amp. Size: 3½in. × 4in. × 3½in. PRICE **15/-**.

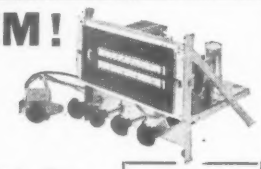
CHOKES:
(G) 40H, 50 mA. Size 3½in. × 3½in. × 3½in. high. PRICE **10/6**.
(H) 10H 100 mA. Size: 2½in. × 2½in. × 3½in. high. PRICE **15/-**.
(I) 5H 100 mA Size 3½in. × 3½in. × 3½in. high. PRICE **12/6**.
(J) 6H. 150 mA. Size 2½in. × 2½in. × 3½in. high. PRICE **10/-**.
(K) (Double choke) 3H 60 mA. 4.5 H. 30 mA. Size: 2½in. × 2½in. × 3½in. high. PRICE **5/-**.

OUTPUT TRANSFORMER:
(L) PRIMARY: 5K ohm (suit 6V6 single ended, etc.). SECONDARY: 2.6-3 ohms. Size: 2½in. × 2½in. × 3½in. high. PRICE **10/-**.

METER RECTIFIERS. 1 m/a. and 5 m/a each at **6/6**. Brand new.

SURPLUS METER BARGAINS
We have large stocks of meters from 50 microamp to 300 v. and will be pleased to forward a complete list upon receipt of 3d. stamp.

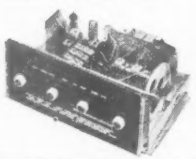
★ STAR ITEM!
A *NEW*
AM/FM CHASSIS
BY LEADING MANUFACTURER!



- ★ Seven valves: ECC85, ECH81, EF85, EABC80, EL84, EZ80, EM81.
- ★ Long, Medium, F.M. Bands and Gram.
- ★ Separate bass and treble controls.
- ★ Illuminated volume control on extended lead.
- ★ Mullard F.M. Tuner Section.
- ★ Attractive dial in Gold on Bronze background (Vertical or Horizontal to choice)
- ★ Fully Guaranteed.
- ★ £18/19/6 Plus 5/- P. & P.

This superb chassis is ideal as an up-to-the-minute replacement or as the basis of a new Radiogram. Dimensions (overall) 12in. L. × 10in. W. × 10in. D. H.P. or Credit Sale Terms Available. Limited Stocks only.

RC4.FAM. AM/FM RADIOGRAM CHASSIS



A new style AM/FM Chassis employing a printed circuit FM Tuner section. Valve line-up: 8 valves ECC85, 6BA6, 12AH8, 6BA6, 6AL5, 6AT6, EL84, 5Y3. Most attractive dial 12 × 5½in., fully illuminated with figures in green, red and white on black background. Four controls: Tuning Volume, Wavechange and Tone/On/Off. Dimensions (overall): 13 × 9 × 6in. Frequency coverage (four wavebands) 1,000-2,000 m. 200-550 m., 15-50 m., 88-100 mc/s. This is an excellent and very efficient chassis. Price **£22/10/-** plus 5/- P. & P.

DULCI F.3.AM. RADIOGRAM CHASSIS

We are very fortunate in being able to offer a further limited quantity of this very popular and efficient chassis at a greatly reduced price. Specification: Three wavebands, Long, Medium and Short. Valve line-up: X79, 6BA6, 6AT6, EL84, 6X4 (or equiv.). Four controls: Tone, ON/OFF, Volume, Wavechange, Tuning. Output 4 watts matched to 3.5 ohms. Incorporates latest Ferrite Rod Aerial. Input sockets for crystal or magnetic pick-up. Provision for mains supply to gram motor. Overall dimensions 12in. L × 7in. D × 7½in. H. Attractive dial with Red, Gold and Green lettering on Black background. Dial size 11½in. × 4½in. Price, whilst stocks last, only **£10/5/-**, plus 3/6 P. & P. Terms available.

GRAMOPHONE MOTORS ARE IN SHORT SUPPLY

COLLARO AC 3/554. Three-speed single player for A.C. mains 200/250 v. Cream finish, complete with turnover crystal pick-up incorporating the well-known high output "T" type head. Strictly limited quantity at **£3/19/6** plus 3/6 P. & P.

COLLARO 4-SPEED single record unit with separate pick-up and HGP59 crystal cartridge. Brand new, few only, **£4/12/6** plus 3/6 P. & P.

BARGAIN CORNER

CONTACT COOLED RECTIFIERS. Westinghouse type 14RA12/8/2, 250 v 200 m/a., **21/-**: 14RA12/8/3, 250 v., 300 m/a., **27/6**. Both plus p. & p. 9d. Few only, brand new.

MULLARD 3-3 HI-FI AMPLIFIER to Mullard spec: Assembled, tested, fully guaranteed. **£3/3/0** plus 3/6 P. & P. Leaflet on request.

BARGAIN PACK (CERAMICS). 55 ceramic capacitors, 11 values, FIVE of each from 5pf to 5,000pf in cellophane pack. **18/6**, post 9d.

931A PHOTO-ELECTRIC MULTIPLIER. Brand new **45/-**, plus P. & P. 1/-.

WIRING WIRE. 5 coils 10 yards each in different colours contained in cellophane bag, **5/-** bag plus 9d. postage.

DECCA Lightweight pick-up complete with Studio "O" turn-over crystal insert and sapphire styli. ONLY **47/6** plus 1/6 P. & P. BRAND NEW.

9in. × 5in. ELLIPTICAL LOUDSPEAKERS Few only. Brand new, **32/6** plus 1/6 P. & P.

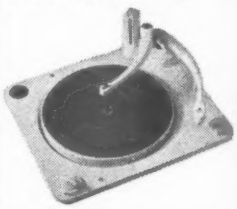
4in. WAFER SPEAKERS. 3 ohm speech coil. Brand new. Few only. **22/6** plus 1/- P. & P.

P.V.C. BASED RECORDING TAPE on plastic spool. By famous manufacturer. Brand new. 7in. 1,200ft. also 5in. 1,200ft. L.P., both at **21/-** per spool or 3 for **60/-**, plus P. & P. 1/6.

BRAND NEW RECORDING TAPE. 1,200ft. Kraft paper based recording tape, **10/6** or 3 for **30/-**.

FOUR-SPEED CHANGERS

B.S.R. MONARCH. Mixer Autochanger, in cream and gold. £8/15/-. Plus p. & p. 3/6. Stocks rapidly diminishing.

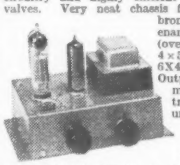


THE LATEST COLLARO "CONQUEST" 4-speed autochanger in cream with Studio "O" insert, **£8/19/6**, plus P. & P. 3/6.

RECORD PLAYER CABINETS — to suit all types of single record and autochanger units. Price from **45/-**. Send stamp for fully illustrated list.

PORTABLE GRAM AMPLIFIERS

RC1.A AMPLIFIER. A small high-quality gramophone amplifier employing the latest circuitry and highly efficient miniature valves. Very neat chassis finished in bronze stove enamel. Size: (overall) 5½ × 4 × 5in. Valves 6X4, ECL82. Output 3 watts max. Controls. Volume. Tone/On/Off. For use on AC mains 200/250 v.



Price **£3/19/6** plus 2/- P. & P.

RC2A. Small PRINTED CIRCUIT single-valve high-gain amplifier for the smaller type of portable. Employs latest type ECL80 valve. Further details on request. Price only **59/6** plus 2/- P. & P.

RC3A. A superior quality 3-valve amplifier employing 6Z80, EL84 and ECC83. With separate Bass and Treble controls. Further details on request. Price: **£3/19/6** plus 2/6 P. & P.

RC4.A. (STALLION). This is supplied complete with high flux 8in. P.M. Speaker and Baffle. Incorporating three octal type valves 6Q7, 6V6 and 6X5, this robust and well-made unit is ideal for use in the larger type of record player and is equally suitable for use in conjunction with a radio feeder unit. Separate bass and treble controls are provided also provision is made for an extension speaker and mains supplied to gram. motor. Output approx. 4 watts. Size overall 13in. × 4in. × 9in. high. For use on A.C. mains 100/200/250 v. PRICE **£5/19/6** plus 2/6 P. & P. H.P. terms **£2/19/6** deposit and four monthly payments of **16/6**. Fits our portable cabinet "G" at **85/-** without modification.

Our advantageous H.P. and Credit Sale terms are available on any single item over £5. Your enquiries invited.

If not stated, please add postage on orders under £1. Cash with order or C.O.D. (charges extra).

Open: Tottenham Court Road: 9 a.m. to 6 p.m. Mon. to Fri., Sat. 1 p.m. Holloway Road: 9 a.m. to 6 p.m. daily Thurs. 1 p.m., Sats. 5.30 p.m.

★ TO BUILD YOURSELF ★

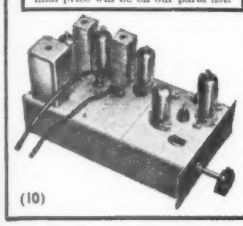
ALL PARTS AVAILABLE SEPARATELY

WE ARE THE EXPERTS IN THIS FIELD AND CARRY THE MOST COMPREHENSIVE STOCKS IN THE COUNTRY

(1)

PRELIMINARY ANNOUNCEMENT

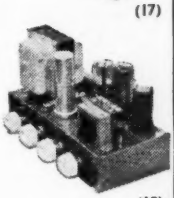
AT LAST! A pocket-sized **SUPERHET** Transistor portable for medium and long-wave reception THAT REALLY WORKS, and at a price YOU can afford. The " R.E.P. MINI—7 " utilising 1 OC45, 2 White Spot and 4 Red Spot Transistors. Push-Pull output. Attractive plastic case, finished in dove grey and scarlet. Size only 5¼in. × 3¼in. × 1⅝in. Incorporates Hi-Grade 2½in. P.M. Loudspeaker, Ferrite Slab Aerial, also drilled and eyeletted Paxolin Chassis. Easy to follow practical and theoretical diagrams and itemised price list available separately at 1/6, post free. At the time of going to press the price has not been finalised but is expected to be UNDER £10! The final price will be on our parts list.



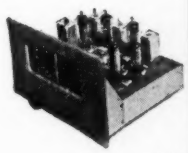
(10)

		All required components at special inclusive price.	P.&P.	Instruction Book and itemised price list available separately
(1)	New Look " RAMBLER " all dry portable	£7 7 0	2/6	1/6
(2)	" RAMBLER " Mains Unit (suitable for most portables)	£2 7 6	1/6	9d.
(3)	" ECONOMY FOUR " T.R F. Mains Receiver	£5 10 0	2/6	1/6
(4)	" FAMILY FOUR " (our new T R.F. Receiver)	£4 19 6	2/6	1/6
(5)	" SUPERIOR FOUR " (Four valve mains receiver)	£6 9 6	2/6	1/6
(6)	GRAM Chassis 5-valve Superhet	£8 8 0	2/6	1/6
(7)	T.S.L. F.M. Tuner (self powered)	£10 19 6	3/6	2/6
(8)	Standard JASON F.M. Tuner	£6 17 6	2/6	2/–
(9)	Fringe area JASON F.M. Tuner	£7 15 0	2/6	2/–
(10)	JASON " MERCURY " Switch tuned F.M. feeder	£9 19 6	2/6	2/–
(11)	OSRAM 912 Printed circuit F.M. Tuner	£8 8 0	2/6	2/6
(12)	JASON " ARGONAUT " AM/FM Chassis	£16 5 0	2/6	2/–
(13)	JASON " ARGONAUT " AM/FM Tuner	£13 19 6	3/6	2/–
(14)	F.M. Power Pack	£1 17 6	1/6	1/–
(15)	R.C. 3/4 watt amplifier (with Bass, Middle & Treble controls)	£4 5 0	2/6	1/–
(16)	2-amp. Battery Charger	£1 18 6	2/6	3d
(17)	R.C. Transistor/Crystal Receiver (with 'Phones)	£1 17 6	1/3	3d.
(18)	R.E.P. 1-valve Battery Receiver „ „	£2 2 0	2/–	9d.
(19)	" CRY-BABY " ALARM (Baby Alarm) (see below)	£3 12 6	2/6	1/–
(20)	? ? ?			

(17)



(15)



(11)

(5)

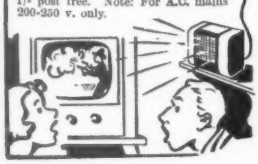
The following are also available assembled and tested:—

(2) " RAMBLER " Mains Unit, £3/5/–; (7) T.S.L. F M. Tuner, £13/15/–; (14) F.M. Power Pack, 52/6; (15) R.C. 3/4 watt Amplifier, £5/5/–; (16) 2-amp. Battery charger, 45/–; (19) " CRY-BABY " Alarm, 89/6. Instruction Books which contain full description, easy-to-follow practical wiring diagrams, theoretical diagrams, itemised price list, etc., are supplied free of charge with all parcels but may be purchased separately if required.

NOTE: (2) The " RAMBLER " Mains Unit is suitable for use with MOST all-dry portables.

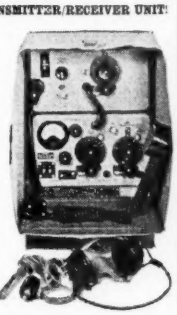
THE **CRY-BABY ALARM**

We proudly present this latest addition to our wide range of popular kits to build yourself. **Enjoy your leisure free from anxiety.** This highly efficient unit is simple to assemble, extremely sensitive and may be installed in a matter of minutes. Completely **SAFE** employing a double wound mains transformer. Attractively finished in Red and Grey (washable) " Lionide " with cream plastic escutcheon. Size only 7¼in. × 3¼in. × 6¼in. Supplied in kit form complete with mike at ONLY 72/6 plus 2/6 P. & P. or assembled and tested 83/3 P. & P.2/6. Suitable mike flex available at 3d. a yd. Instruction book and price list available separately 1/- post free. Note: For A.C. mains 200-250 v. only.



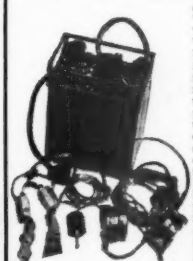
N.B.—All our T.R.F. Kit circuits include specially wound Denco " Max Q " coils on polystyrene formers. Improved performance. Price remains the same.

No. 18 TRANSMITTER/RECEIVER UNIT



We have just taken delivery of a quantity of these fine units, brand new and complete. This is a very good portable, self-contained transmitter/receiver designed for short range telephony and C.W. Range: approx. 5 miles. Frequency coverage 6 mc/s.-9 mc/s. All accessories supplied, i.e., Headphone, Mike, Morse Key, Aerial, comprehensive instruction book with circuit diagram. Valve line-up: 3 A.R.P.12, 2 ARS, 1 ATP4. Weight approx. 22lb. Dimensions (overall): 8in. × 10in. × 17in. **UNREPEATABLE at 99/6 plus 7/6 C. & P.**

No. 38 TRANSMITTER/RECEIVER



(popular Walkie-Talkie) We have been most fortunate in obtaining a further supply of these complete stations comprising TX/RX unit, headphones, microphone, aerial, junction box, battery satchel and full operating instructions. Range: approx. 5 miles. Frequency coverage 7.4-9 mc/s. ABSOLUTELY BRAND NEW, 65/-. Export enquiries invited.

SPECIAL PURCHASE from MINISTRY BRAND NEW No. 17 Mk. II TRANSMITTER/RECEIVER

Built into strong wooden cabinet 15in. × 14in. × 9in. Complete with headphones and microphone. Range 5-8 miles with simple aerial. Frequency coverage 44-61 mc/s. (5-7 metres) Uses standard 120 v. H.T. and 2-volt L.T. batteries. Complete with full operating instructions. **59/6.**

CONSTRUCTOR'S NOTE ! !
RADIO DATA BOOKS AVAILABLE, i.e., Valve guide, Colour code, etc. Send stamp for list.

HAVE YOU HAD A COPY OF OUR COMPREHENSIVE CATALOGUE ?

This invaluable publication containing 109 well-illustrated pages o useful information, prices, etc., is available at 2/- post free. Complete coupon provided in BLOCK CAPITALS and forward to us, with your remittance, for immediate despatch.

CLYNE RADIO LTD.

18 Tottenham Court Road, London, W.1
and at
162 Holloway Road, London, N.7

CATALOGUE

To: Name.....

Address .....

.....

.....

W

ENCLOSED HEREWITH **2/-**

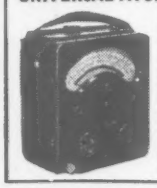
DATE

CUT OUT ALONG DOTTED LINE

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

UNIVERSAL AVOMETER MODEL "D"



10 D.C. volt ranges, 150 Mv. to 1.5 kv. 8 A.C. volt ranges, 7.5 v. to 1.5 kv. 8 D.C. current ranges, 15 ma. to 30 amp. 6 A.C. current ranges, 75 ma. to 15 amp. Resistance ranges, 1K. and 10 K. ohms. Supplied in perfect order with instructions and leads. £8/19/6 each. P/P. 4/–.

ADVANCE CONSTANT VOLTAGE TRANSFORMERS. Input 190 to 260 volts. A.C. 50 cycles. Output constant at 230 volts. Max. rating 150 watts. Supplied brand new in original crates. £8/10/– each. P/P. 5/–.

TRIPLETT 100 MICROAMP 4in. METERS. Square face, flush fitting. Scaled volts, ohms, Ma. Ideal for test meter. Brand new 79/6 each. P/P. 1/6.

HEAVY DUTY AUTO TRANSFORMERS. 110/230 volts, 750 watts. Brand new, only 69/6 each. P/P. 5/–. Also 100 watt, 15/6, 150 watt, 21/–. P/P. 1/6.

POST OFFICE TELEPHONE HANDSETS Standard type, brand new, boxed, 12/6 each. P/P. 1/3.

TAYLOR 6in. 50 MICROAMP METERS. Square face, flush fitting. Brand new, boxed, £5/19/6 each. P/P. 1/6.

2 VOLT 3 A.H. ACCUMULATORS. Exide, new, unfilled. 2/– each. P/P. 9d. Block of 12 21/–. P/P. 4/6.

JOHNSON TX. CONDENSERS. 500 PF variables. Brand new, boxed, 15/6 each. P/P. 1/–. New, boxed, Johnson variable inductances, 22/6 P/P. 2/6.

AMERICAN SUPER LIGHTWEIGHT HEADPHONES. Res. 50 ohms. Fitted with rubber earmoulds to fit inside the ear. extremely good quality, ideal for communication receivers, etc. New and boxed. 15/– pair. P/P. 1/–.

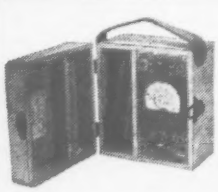
FERRANTI POTTED FILAMENT TRANSFORMERS. Hermetically sealed, ceramic terminations. All new and boxed. Type 1,200/250 v. input. Output 6.3 v. CT. 5.6 a., tapped 5 v. 6.3 v. CT. 4.8 a. tapped 4 v. 6.3 v. CT. 1 a. tapped 4 v., 19/6 each. Type 2. Input 200/250 v. Outputs, 6.3 v. CT. 3.3 a. tapped 5 v. 6.3 v. CT. 1 a. tapped 4 v. 6.3 v. CT. .9 a. 6.3 v. CT. .6 a., 15/6 each. P/P. 2/– each type.

L.T. TRANSFORMER BARGAINS. Type 1. 200/250 volt Input. Output tapped 3, 6, 9, 12, 24 or 36 volts 5 amps. 35/– each. P/P. 3/–. Type 2. 200/250 volt input. Output 12 volts 5 amps. 12/6 each. P/P. 2/–.

AR.88 WAVECHANGE SWITCHES. Spare for Model D. Ceramic, 8 bank, 6 pos., complete with all screens Brand new. 17/6 each. P/P. 2/6.

AVO MINOR LEATHER CASES. Brand new, 7/6 each. P/P. 1/–.

AMERICAN MULTI-RANGE TEST METERS



1,000 ohms per volt. 400 micro-amp basis movement. Ranges volts, A.C. or D.C. 2.5, 10, 50, 250, 1,000 and 5,000 v.D.C. current. 1 ma., 10 ma., 100 ma. and 1 amp. Ohms. 500, 100 k. and 1 meg. Decibels, −10 to +69. Complete with test prods and instructions. As new, tested before despatch. £5/19/6 each. P/P. 3/–.

WAYNE KERR INSULATION TEST SETS. No. 5. 200/250 v. A.C operation, giving a variable output of 1 kv. to 5 kv. A.C. or D.C., calibrated on 4in. meter. Supplied in good working order complete with EHT probes. £9/19/6 each. P/P. 10/–.

TAYLOR MODEL 160A OUTPUT METER. Incorporates 4in. meter calibrated 0–25 mW Meter multiplier, .01-.1-1-10-100. Impedance matching 2.5-5-100-125-150-600-4,000-8,000-10,000-20,000 ohms. Supplied brand new, boxed and tested, £14/10/– each. P/P. 5/–.

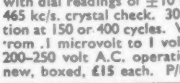
COSSOR DOUBLE BEAM OSCILLOSCOPE TYPE 339

Operation 110/200/250 volts A.C. 120 watts. Time Base 10 positions. 6 cps to 250,000 cps. Amplifier 10 cps. to 2,000,000 cps. Sensitivity, Y1 Y2.3.1 v. D.C. 1.1 v. rms. X. 2.25 v. D.C. .8 v. rms.

Supplied in good working order, complete with handbook and circuit. £27/10/– each P/P. £1.

I.F. ALIGNMENT OSCILLATORS A laboratory instrument, sub-standard accuracy, three ranges 455, 465 and 475 kc/s., with dial readings of ±10 kc/s. on each range. 465 kc/s. crystal check. 30% internal modulation at 150 or 400 cycles. Variable attenuation from .1 microvolt to 1 volt, 1 DB to 100 DB. 200–250 volt A.C. operation, supplied brand new, boxed, £15 each. P/P. 10/–.

W.1191 WAVEMETERS



Portable precision battery operated frequency check meters, coverage 100 kc/s. to 20 mc/s. Supplied complete with all valves and 1 mc/s. Xtal and calibration charts. £5/19/6 each. P/P. 6/–.

RCA. ET.4336 PLATE TRANSFORMERS. Special release, brand new in original maker's transit cases. Primary tapped 200 to 250 volts 50 cycles. Secondary 2,000/0/2,000 volts 400 ma., tapped 1,500/0/1,500 volts. Price £12/10/– each. P./P. £1.

A.C. MAINS VOLTAGE REGULATOR TRANSFORMERS. Input 230 volts. Output variable from 185 to 250 volts at a max. rating of 24 amps. Ideal for laboratory use, etc., supplied as new. £15 each. P./P. 10/–.

MUIRHEAD PRECISION STUD SWITCHES. Brand new and boxed. 4 banks, each bank 24 position. Heavy duty contacts. Only 17/6 each. P/P. 1/6.

EDDYSTONE MAINS POWER PACKS S.441B. Supplied brand new and unused. Input 200/250 volts. Output 300 volts 200 ma. and 12 volts 3 amps. Double choke and condenser smoothed, 5U4 rectifier. Housed in grey metal case, fully fused, indicator, etc. Only 49/6 each. P/P. 6/–.

ALKALINE NIFE ACCUMULATORS

Banks of 10 cells giving 12 volts 45 A.H. Unused in wooden crates, £5/10/– each. P/P. 7/6.

"C" CORE TRANSFORMERS

Special offer, all brand new and boxed. All types have 230 volt 50 cycle input. Type 1. 510/0/510 v. 300 ma., 375/0/375 v. 100 ma., 6.3 v. 9 a., 2×6.3 v. 2 a., 2×6.3 v. 1 a., 6.3 v. 1.5 a. 6.3 v. .5 a., 5 v. 3 a., 82/6. P/P. 5/–. Type 2. 450/0/450 v. 250 ma., 2×6.3 v. 5 a., 2×6.3 v. 1 a., 5 v. 4 a., 65/–. P/P. 4/6. Type 3. 450/0/450 v. 220 ma., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., 59/6. P/P 4/–. Type 4. 350/0/350 v. 400 ma., 25 v. 1 a., 21 v. .5 a., 6.3 v. 5 a., 6.3 v. 1 a. 5 v. 4 a., 65/–. P/P. 4/6. Type 5. 360/0/360 v 200 ma., 360/0/360 v. 65 ma., 6.3 v CT 5 a., 6.3 v. CT 2 a., 6.3 v. 5 a., 5 v. 4 a., 5 v 3 a., 65/– P/P. 4/6. Type 6. 3 850 v. 5 ma., 4 v. 2.5 a., 4 v. 1 a., 52/6. P/P. 3/–. Type 7. 1,250/0/1,250 v. 5.5 ma., 6.3 v. 1 a., 6.3 v. 1 a., 4 v. 1 a., 42/6. P/P. 2/6. Type 8. 6.3 v. 5 a., 6.3 v. 4 a., 2×6.3 v. 3 a., 6.3 v. 2 a., 6.3 v. 1.5 a., 6.3 v 1 a., 45/–. P/P. 2/6. Type 9. 3×6.3 v. 3 a. 6.3 v. 1.5 a., 32/6. P/P. 2/–.

6-VOLT VIBRATOR POWER PACKS. Output 120 volts 30 ma. Fully smoothed, uses standard 4-pin Mallory vibrator. New and boxed. 12/6 each. P/P. 2/6.

D.C./A.C. ROTARY CONVERTOR. Input 24 volts D.C. Output 230 volts 50 cycles A.C., 100 watts. Unused 92/6 each. P/P. 5/–.

AMERICAN ROTARY TRANSFORMERS. Models available for either 6 or 12 volt D.C. Input. Output 250 volts 80 ma. Ideal for car radios or razors, etc., new and unused, 22/6 each. P/P. 3/–.

AMERICAN GEARED MOTORS. American 24 volt D.C. motor with built-in precision gearbox giving twin outputs 20 r.p.m. and 6 r.p.m. Will also operate on 12 v. giving reduced outputs. Size 7×1¾in. Shaft dia. ¼in. Supplied brand new only. P/P. 3/–. **19/6** each.

MARCONI TF-643 SUB-STANDARD WAVEMETERS. Frequency coverage 20 to 300 mc/s. in 4 bands. Supplied as new with all coils and calibration charts. £19/10/– each. P/P. 6/–.

R.1155 SUPER SLOW MOTION DRIVES. Improved version as fitted to Models L and N. Suitable for Model A, etc. Brand new 12/6 each. P/P. 1/–.

AVO BATTERY ELIMINATOR POWER PACKS. Operation 200/250 volts A.C. Output 1.4 volts at 300 ma. and 67 volts at 10 ma. Stabilised by VS70, whole unit fully fused. Size 8½×5×3½in. Ideal for personal battery sets, etc., supplied brand new in maker's cartons. 39/6 each. P/P. 2/6.

AVO MODEL 7 MULTIPLIERS. Extends 1,000-volt range to 4,000 volts. New, boxed, 5/6 each. P/P. 1/–.

MUIRHEAD VERNIER DRIVES. Brand new, 7/6 each. P/P. 1/–.

EVERSHED AND VIGNOLES WEE-MEGGER 500 VOLTS.

Special release, brand new and unused, complete with leather carrying case, only £12/10/– each. P/P. 2/6 Also available secondhand models, but perfect working order complete with leather case, £8/10/– each. P/P. 2/6.

G.E.C. SELECTEST MULTI-RANGE METERS. Basic movement 1 ma. 1,000 ohms per volt. Resistance ranges, 0 to 1 megohm. D.C. volts from .15 v. to 1.5 kv. A.C. volts from 7.5 v. to 1.5 kv. A.C. current from 75 ma. to 15 amp. D.C. current from 1.5 ma. to 30 amp. Incorporates safety cut-out. Supplied in perfect working order, complete with leads. **£9/19/6** each. P/P. 3/6.

CRYSTAL MICROPHONE INSERTS Sensitive, ideal for amplifiers, tape recorders, etc., 4/6 each P/P. 6d.

12-VOLT MIDGET ROTARY TRANSFORMERS. Type H.T.11, size 4½×2¾in. Output 310/360 volts 30 ma New and boxed **22/6.** P/P. 1/6.

EX NAVY SOUND-POWERED TELEPHONES. This type requires no batteries to operate and can be fitted in moments to give complete inter-communication between two points. Hand generator calling. Only 45/- each. P/P. 4/6.

300ft. COPPER AERIAL WIRE. Ex U.S.A. Brand new. 3/6 reel. P/P. 1/-.

HEAVY DUTY SLIDER RESISTANCES 1 ohm 12 amp **6/6** each. P/P. 1/-.

MINIATURE H.T. TRANSFORMER. Input 220/240 v. Output 220 v. 25 ma. 6.3 v. 1 a., new, 10/6 each. P/P. 1/-. Midget contact rectifier to match, **7/6.**

METER BARGAINS

50 microamp, 2½in. PJ.M.C.	**49/6**
100 microamp 2½in F.M.M.C.	**39/6**
500/0/500 microamp, 3½in. F.M.M.C.	**49/6**
500/0/500 microamp, 2½in. PJ.M.C.	**19/6**
50/0/50 microamp, 2½in. F.M.M.C.	**69/6**
50 microamp, 2½in. F.M.M.C.	**59/6**
30 ma. 2½in. F.M.M.C.	**9/6**
1 ma., 2½in. F.M.M.C.	**25/-**
200 ma., 2½in. F.M.M.C.	**9/6**
1 amp., 2½in. F.M.M.C.	**10/6**
1.5 amp., 2in. F.M.M.I.	**6/6**
7.5 amps. 3½in. PJMI.	**10/6**
300 volt A.C., 2½in. F.M.M.I.	**25/-**
4 kv. electrostatic, 3½in. F.M.	**59/6**
15 volt A.C./D.C. 2½" F.M.M.I.	**9/6**
5/0/5 mA 2" F.M.M.C.	**15/-**

AMERICAN No. 19 Mk. II TRANSMITTER-RECEIVERS. Brand new, complete with all valves, only **65/-** each. P/P. 10/-.

VARIAC TRANSFORMERS. Input 230 volt, Output variable from 0–250 volts, 9 amps. **£12/10/-** each, P./P. 5/-.

WESTON MODEL 722 TESTMETER

An ideal bench or portable instrument. Incorporates 5 A.C. or D.C. volt ranges. 2.5 v. to 1,000 volts. 6 D.C. current ranges 100 microamp to 500 ma. A.C. current, 500 ma., 1 amp., 5 amps. Resistance, 100 ohms 1 K., 100 K. and 10 megohm Supplied thoroughly tested in rexine covered carrying case with instructions and leads. **£10/10/-** each. P/P. 4/-.

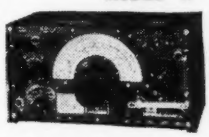
EDDYSTONE MAINS POWER PACKS

Supplied brand new and unused. Mains input 200/250 volts. Output 175 volts 60 ma. and 12 v. 2.5 a. Double choke and condenser smoothed. 5Z4 rectifier. Housed in grey metal case. Only **32/6** each. P/P. 3/6

SUB-STANDARD AMMETERS
9 ranges. 150 ma. 1.5 a., 3.0 a., 7.5 a., 15 a., 30 a., 60 a., 300 a. and 450 a. Portable instruments in teak case. 8in. mirror scale. Supplied brand new complete with all shunts, leather carrying case and test certificate. **£15** each. P/P. 10/-.

PORTABLE PRECISON VOLTMETERS
Brand new and boxed instruments by famous manufacturer. Housed in polished teak case. Moving iron movement reading A.C. or D.C. volts on 2 ranges. 0-160 v. and 0-320 v. 8in. mirror scale. Accuracy within 2%. Supplied at a fraction of original cost. Only **£5/19/6** each. P/P. 3/6.

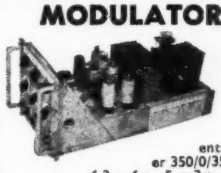
R.1155 COMMUNICATION RECEIVERS MODEL "N"



Incorporating the trawler band. Frequency coverage: 200-500 kc/s. 600-1.500 kc/s. 1.5-3 mc/s 3-7.5 mc/s. and 7.5-18 mc/s. Supplied in perfect working order, aerial tested, with illustrated leaflet, **£12/19/6** each. P/P. 7/6. Standard models available but fitted with improved dial drive as above model, **£8/19/6** each. Combined A.C. mains power packs and output stage available. **85/-** each. P/P. 3/6.

SPECIAL OFFER
OF MARCONI SIGNAL GENERATORS TF-517. Frequency coverage 10 to 18 mc/s. and 33 to 58 and 150 to 300 mc/s. Operation 200/250 volts A.C. Supplied in good condition at the ridiculous price of **£12/10/-** each. P/P. £1.

MODULATOR 67



A wonderful complete A.C. mains power pack containing the following components. Transformer 350/0/350 v. 200 ma., 6.3 v. 6 a., 5 v. 3 a. Input 230 v. 200 ma., choke, 5Z4 rectifier Paper and electrolytic smoothing condensers. 11 other useful valves. Hundreds of components including switches, pots, condensers, resistors, etc. Supplied brand new with covers.

SPECIAL REDUCED PRICE 39/6 each
P/P. 7/6

AMERICAN TRIPLETT MULTI-RANGE TESTMETERS 1,000 ohms per volt. Incorporates the following ranges. Volts A.C. 10 to 5 kv. Volts D.C. 10 to 5 kv Current D.C. 10 ma to 500 ma. and 2 resistance ranges, 300 ohms and 250 K. ohms. Supplied in working order with leads. **£4/17/6** each. P/P. 2/6.

HEAVY DUTY MAINS ISOLATING TRANSFORMERS. Specifications: Primary 230 volts 3 amps Secondary 230 volts 3 amps (service rating, OK 5 amps.). Ideal for laboratory or workshop use. Supplied brand new in original transit cases **£6/10/-** each. P/P. 10/-.

RCA. OUTPUT TRANSFORMERS. Completely potted. Centre-tapped primary, 8,000 ohms. Secondary tapped 3, 7.5 15 or 600 ohms. Separate feedback winding. 15 watts rating. Suitable for 6L6, EL84, etc., unused, **27/6** each. P/P. 2/-.

EVERSHED AND VIGNOLES MEGGER OHMMETERS

Ideal for all polarity and continuity tests. Supplied brand new with all leads and instructions, only **59/6** each. P/P. 2/-.

CHARGING AND MODEL TRANSFORMERS
1. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 1 amp., **9/9.**
2. Pri. 200/250 v. Sec 3.5, 9 or 17 v. 2 amp., **14/3.**
3. Pri. 200/250 v Sec. 3.5, 9 or 17 v. 4 amp., **16/6.**
Postage 1/6 all types.

L.T. METAL RECTIFIERS. Full wave and bridged. 12 v. 1 amp., **6/3**; 12 v. 2 amp., **9/3**; 12 v. 4 amp., **13/9**; 24 v. 1 amp., **12/6**; 24 v. 4 amp., **22/6**; 36 v. 4 amp., **27/6.** P./P 1/- all types.

MARCONI TF.144G. STANDARD SIGNAL GENERATORS. 85 kc/s. to 25 mc/s. Reconditioned as new, **£65** each. P/P. £1. Marconi TF-853/854 10 cm. signal generator brand new, **£100.** P/P. £2. TF-390 G., from **£12/10/-.**

AMERICAN AUTO TRANSFORMERS 110/230 volts. 40 watts. Small size, fully shrouded Ideal for instruments, shavers, etc. Brand new, boxed, **12/6** each. P/P 1/9.

INSTRUMENT POTENTIOMETERS. Brand new Colvern type. 100,000 ohms, 10 watts, 3½in. dia. Ideal for bridges, etc., **10/6** each P/P. 1/-.

BARGAIN GRAM. MOTORS. Garrard centre-drive motors complete with turntables 200/250 volt A.C. Adjustable mechanically from 0 to 45 r.p.m Only **22/6** each. P/P 3/-.

SMOOTHING CHOKE BARGAINS. 10H. 60 ma., **4/6**; 15H, 60 ma. **5/6**; 8H, 100 ma., **8/6**; 9H, 100 ma., **7/6**; 10H. 100 ma., **8/6**; 5H, 200 ma., **5/6**; 20H, 120 ma., **10/6**; 50H, 120 ma., **15/6**; swinging choke 3.6-4.2 H, 250 ma., **10/6.** P./P. 1/- to 2/6.

12-VOLT MOBILE AMPLIFIERS. Ex Admiralty Separate mic. or gram. inputs. Output 10 watts, matched to 3, 15 or 600 ohms Supplied in good working order. **£8/19/6** each. P/P. 5/-.

DYNAMO EXPLODER UNITS. Used for detonating explosive charges Operation is by hand generator, giving 1,800 volts across output terminals Ideal also as photo flash. Brand new, only **29/6** each. P/P. 3/-.

MIDGET RECORDER MOTORS. Size 1½×1×2¾in Operates from 4.5 to 24 v. D.C. Fitted with reduction gear. New and boxed. **12/6** each. P/P. 1/-.

MINIATURE SLOW MOTION DRIVES. Dia. 1¾in 180 deg. scale calibrated 0–100. For ¼in. spindles. New and boxed, **7/6** each. P/P. 1/-. Larger type available **7/6** each.

POST OFFICE JUMPER LEADS. Fitted with 2 standard jack plugs, brand new 3/-. P./P. **6d.** Panel jacks to fit **9d.**

MARCONI T.F. 373 IMPEDANCE BRIDGES as new **£55** each, P./P. **15/-.**

LEACH AERIAL CHANGE-OVER RELAYS
12 v. Double Pole Ceramic Insulation, New and Boxed **7/6** each, P.P. 9d.

UNIVERSAL AVOMINOR TEST-METERS. Small, compact, accurate instrument. Resistance measurements from 0 to 20 k. ohms. D.C. volts from 0 to 500 v. A.C. volts from 0 to 500 v. D.C. current from 0 to 500 ma. Supplied in perfect working order, complete with leather case and leads. **£5/10/-** each. P/P. 2/6

G. W. SMITH & CO (RADIO) LIMITED
Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

Visit the City's new acoustically designed

HI-FI Centre

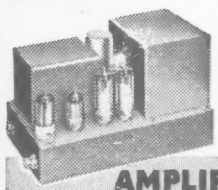
Business Hours
Weekdays 9 - 6
Saturdays 9 - 1

Electronics (FLEET ST.) Ltd

Dept. B.
152/3 Fleet St.,
London, E.C.4
Telephone: FLE 2833

AMPLIFIERS
PRE-AMPLIFIERS
CONTROL UNITS

Frequency response within one DB 20 c/s to 20 kc/s. Output 4-8-15 ohms imp.



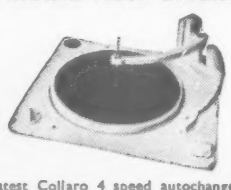
Pre-amp. 10db to 110 db at 10,000 c/s. Bass control —5 db to 11 db at 20 c/s. Fully guaranteed. Exceptional value 20 gns. (Plus 5/- post and ins.).

AMPLIFIER AND PRE-AMPLIFIER

GOODSELL MA2 AMPLIFIER AND TONE CONTROL. 6 watt p/pull output. Linear freq. response 52 CPS-50,000 CPS. Linear power response 6 watt nominal. Full base and treble control. L.P. 78 r.p.m. tape and radio reproduction. Price complete £19/15/-. (Plus 5/- post and ins.).

THE DULCI GA4 4 WATT, 4 VALVE AMPLIFIER with control panel for remote mounting. Separate bass and treble control selector switch. Matched to radio, L.P. and 78 records. Price £9/9/-. (Plus 4/- post and ins.).

BRAND NEW OFFER!

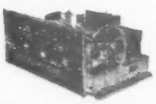


The latest Collaro 4 speed autochanger with studio t/over pick-up. Our price £7/19/6. (Plus 5/- post and ins.).

TUNER UNITS
AM/FM CHASSIS
RADIOGRAM CHASSIS
BY LEADING MAKERS

AMPLIFIERS BY:—Armstrong, Rogers, Leak, Verdik, Dulci, Goodsell, Quad, etc. In stock.

1958 AM/FM RADIOGRAM CHASSIS



8 valve AM/FM chassis with printed circuit FM tuner section. Illuminated dial in 4 colours. 4 waveband coverage 1,000-2,000 metres. 200-550 metres. 15-50 metres. 88-100 mc/s. Fully guaranteed. Exceptional value. Only £22/10/-. (Plus 7/6 post and ins.).

THE DULCI H4T
AM/FM Tuner Chassis with power pack covering VHF, short medium and long waves, magic eye tuning, can be used with Hi-Fi amplifiers. Price £20/17/-. (Plus 6/- post and ins.).

COMPREHENSIVE RANGE OF HI-FI LOUDSPEAKER SYSTEMS.

GOODSELL SWITCHED VHF, FM TUNER
Highly sensitive instant station selection Autofrequency control giving freedom from drift. A recommendable tuner. Ready for use. £16/9/-. (Plus 5/- post and ins.).

THE POPULAR MULLARD 5/10 P/PULL AMPLIFIER. Freq. response from 10-20,000 CPS suitable with any crystal p/up. Completely assembled. Exceptional value £12/10/-. (Plus 10/- post and ins.), Mullard pre-amplifier assembled unit incorporating switches for radio microphone LP and 78 records. Power supply from main amplifier. Price £4. (Plus 3/6 post and ins.).

HI-FI AMPLIFIERS IN STOCK

The new Leak TL12 plus amplifier with the "Veriscope" Pre-Amp. 33 gns.

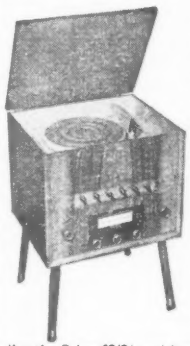
The Leak "Variscope" Pre-Amp. only 15 gns.

The Rogers Junior and tone control unit £16.

The Armstrong Mk. II A10 Amplifier with tone control unit £32.

NOW IN STOCK Collaro 4 speed transcription turntable and pick-up, £19/10/-. Post and Packing 7/6.

B.S.R. 4 speed Model T.U.8. Autochanger, plays 7in., 10in., and 12in. mixed records. Crystal T/O pick-up. £7/19/6. (Plus 5/- post and ins.).



CABINETS
A large stock of new design radiogram cabinets, speaker enclosures, portable auto and non-auto gram. cabinets at competitive prices. This new Hi-Fi cabinet in walnut finish will accommodate every autochanger or transcription turntable, every amplifier and most tuner units. Dimensions: external, 20in. wide x 16in. deep x 29in. high with 12in. legs. Back and bottom ventilated. Price £9/9/-, without legs £7/14/-.

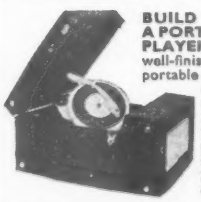
DULCI DPA10 AMPLIFIER
10/14 watt amplifier only 12 gns.
Amplifier and control unit, 15 gns.
Amplifier and pre-amp 19 gns.
(Plus 5/- post and ins.).

SPECIAL OFFER

4 SPEED COLLARO 4/546 single player with studio t/over pick-up. Limited number only. Our price £6/19/6. (Plus 5/- post and ins.).

THE NEW B.S.R. 4 SPEED TU9 record player using the new B.S.R. ful-Fi crystal cartridge. Our price £4/12/6. (Plus 4/- post and ins.).

ALL TYPES OF PICK-UP CARTRIDGES AND STYLI IN STOCK.



BUILD YOURSELF A PORTABLE RECORD PLAYER comprising well-finished two-tone portable cabinet, Collaro 4 speed player, with crystal t/over pick-up 3 watt printed circuit amplifier, 6½in. P.M. speaker. Our price for all the above £11/10/-

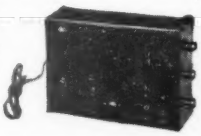
(Plus 10/6 post and ins.).

THE NEW MULLARD 3/3 AMPLIFIER. A compact and well made amplifier giving good quality reproduction in stove enamel finish. Completely assembled for £7/19/6 plus 4/- post and packing.

Everything for the constructor at money-saving prices.

MOVING COIL PM SPEAKERS

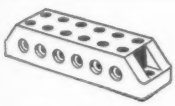
2½in. 3 ohms impedance 16/6
5in. Elac 3 ohms impedance 17/6
6½in. R & A 3 ohms impedance 18/6
8in. Goodmans 3 ohms impedance 20/–
7 × 4in. Goodmans elliptical 18/6
Plus 2/6 post and ins.



Our new improved I.T.A. CONVERTER with internal cross-over filter. A reliable unit. Price £4/19/6 Plus 2/6 post and ins.

CO-AX CABLE
75 ohm stranded cable. Per yard ... 7d.
75 ohm stranded cable specially for I.T.A. Per yard ..... 9d.
8/6d. per dozen yards.

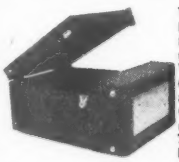
ALL TYPES of co-ax plugs, sockets, crossovers, TV aerials in stock at competitive prices.



New 6-way bakelite terminal block base fixing. 2/–.

New standard 5in. plastic take-up spools, 3/–. Standard 7in. plastic take-up spools..... 3/9

All makes of tape take-up spools and recording accessories in stock.



Well constructed PORTABLE CABINET in attractive two-tone colour. Will house amplifier, 6½in. speaker and any auto-changer, e.g., Collaro, B.S.R., Garrard. Our price 72/6. Plus 5/– post & ins.

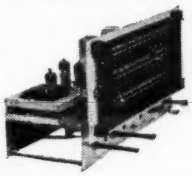
STOP PRESS
3 extra special offers in speakers:—
12in. Plessey PM speaker, 3 ohm speech coil, 32/6. Plus 2/6 post and ins.
10in. Rola PM speaker, 3 ohm speech coil. Astounding value, only 24/6. Plus 2/6 p. & ins.
4½in. Plessey PM speaker, 3 ohm speech coil, 14/9. Plus 1/6 post.

ONE OF OUR REPEAT LINES
Brand new recording tape, 1,200ft. Kraft paper base, per spool 10/6
Plus 1/– post and ins.

TAPE DECKS. The latest "Collaro" Tape transcriptor Mk. II with digital counter, £22, carriage 21/-.
The New Lane deck, £18/10/-, plus 21/- carriage.
The new Brennell deck £23/2/-, plus 21/- carr.

PERSPEX FILTER PANELS. 10in. × 12½in., 4/6; 11½in. × 15½in., 6/6; 13½in. × 16½in., 8/6. Post and packing 1/-.

Brand New 5-valve RADIOGRAM CHASSIS complete with valves



Superhet with long, medium and short wave bands. Pick-up and ex. speaker sockets. Our price £9/10/– Plus 7/6 p. & ins.

SPECIAL OFFERS TO TRANSISTOR CONSTRUCTORS. New range of subminiature capacitors by well-known manufacturer.

1 uf 18 v 2/6	16 uf 12.5 v. ... 3/6
1.6 uf 6 v. 2/6	25 uf 6 v. 3/6
2.5 uf 6 v. 3/–	32 uf 3 v. ... 3/6
5 uf 12.5 v..... 3/–	25 uf 25 v. ... 3/6
8 uf 6 v. 3/6	80 uf 6 v. ... 3/6

2½in. ROUND SPEAKER
1½in. deep 16/6
Plus 1/– post.

Brand new Jackson "00" twin-gang condenser 9/6

SUB-MINIATURE POTS. ¼ meg., 2in. spindle 2/–

TRANSISTORS. Junction type PNP. Red-spot audio freq. Blue-spot mixer and frequency changer. White-spot.

All TELETRON and REPANCO transistor components in stock.

PICK-UP SNIP
Featherweight pick-up with HGP 59/1 t/over cartridge and pick-up rest..... 32/6
Plus 1/6 post and ins.

ANOTHER BARGAIN
New .0005 miniature two-gang condenser by famous manufacturer. ¼" Spindle only 6/9
Plus 1/– post.

METERS
0–1 M/amp meter, m/c flush mounting 17/6
0–100 amps 50 cps, 4½in. meter..... £2/10/–
0–50 amps moving iron 6in. meter..... £3/10/–
All brand new and boxed. Post and ins. 1/6.

AIR-SPACED TRIMMERS
Pre-set and spindle types: 5 pf, 10 pf, 15 pf, 20 pf, 25 pf, 50 pf and 75 pf ..... 2/– each

BELLING LEE PLUGS
Sockets: 5-pin, 1/9. 7-pin, 2/–.

4-pole 3-way ceramic switch 3/6

A SNIP. Film inductries precision made co-ax. plugs and sockets. 2/- each, 3/6 pair. Post 6d.

BURGESS micro switches, 2/- each.

THE IDEAL AMPLIFIER for your portable record player, 2 valve printed circuit, 3 watt output, using Mullard U785 and UCL83. Completely assembled, 52/6, plus 2/6 post and packing.

PAXOLIN SHEET
18 × 4½ × ⅛in. 1/6
10 × 10 × ⅛in. 1/6
20 × 10 × ⅛in. 3/–
10 × 10 × ¼in. 2/–
20 × 10 × ¼in. 4/–
Minimum post and ins. 1/6.

Philips Trimmer Tools ..... 1/– each

BRAND NEW
6 and 12 v. car charger, 1½ amp multi tapped mains input, A.C. 200/20, 230/50. Well made in stove enamel box. Only 42/6
1/6 post and ins.

MICRO SWITCHES by BURGESS, 2/3 ea.
4-way push-button units ..... 2/6 each
Knobs for same ..... 3/– doz.

JONES PLUGS AND SOCKETS
4-pin 2/6 pair; 6-pin 3/6 pair; 8-pin 4/6 pair; 12-pin 6/6 pair. Covers 1/6 extra.
Min. post and ins. 1/6.

COLVERN Flat Slider Resistors. T.V. replacements ..... 2/3 each

COLVERN Round Slider Resistors. T.V. replacements ..... 3/9 each

THE NEW AVO MULTIMINOR TEST METER.

19 ranges A.C. and D.C., 10,000 ohms per volt D.C., 1,000 ohms per volt A.C. Pocket size complete with test leads £9/10/–
Plus 3/6 post and ins.

MUIRHEAD. Vernier drive 0–180° scale. 3" Diameter, complete with lamp holder. New, in manufacturer's box, ... 10/6
Plus 1/6 post.

Q MAX CHASSIS CUTTERS with KEYS The easiest quickest way of cutting holes in sheet metal. Cutter is in three parts, die, punch and Allen key. ⅜in. 13/9, ½in. 14/9, 1in., 1¼in. and 1½in. 17/6, 1⅝in., 1¾in. 19/6. Price includes keys. Post 1/– extra.

GARRARD 4-SPEED player unit with GC2 turnover cartridge for L.P. and standard playing. £7/10/-, plus 5/- post and packing.

0005 single gang tuning condenser 4/9, postage 1/-.

New semi-midget HiQ 465 kc/s IF transformers, dust core tuning by well known maker. 5/6 pair, post 1/-.

SENSITIVE GERMANIUM DIODES. 3 for 2/6. New GD3 diodes 2/6 each. Mullard OA71 diodes 6/-. Postage 6d.

This company is no longer one of the Elpreq Group but for the convenience of customers we shall continue to stock most of their advertised lines.

H.P. facilities available to personal shoppers.

Electronics (FLEET ST.) Ltd

Dept. B,
152/3 FLEET ST., LONDON, E.C.4.
Telephone: FLE 2833
Business Hours: Weekdays 9-6, Saturdays 9-1.

RADIO CLEARANCE LTD.

TRADE ENQUIRIES INVITED

27, TOTTENHAM COURT RD., LONDON, W.1.

Telephone : MUSEUM 9188 EST 30 YRS

The oldest Component Specialists in the trade

ELECTROLYTIC CONDENSERS — WE HOLD THE LARGEST STOCK OF ELECTROLYTICS IN ENGLAND

ABBREVIATIONS: C. Clip mounting tag ends. P. Prong mounting. T. Tag ended. S. Sleeved. W. Wire ended. L.T. Long Tags.

2 MFD. 50 v. ½in. × 1in. LT. 9d. **2 MFD. 50 v.** ⅞in. × 1¼in. W-S 10d. **4 MFD. 6 v.** ⅜in. × 1in. LT. 9d. **5 MFD. 25 v.** ⅞in. × 1¼in. W. 10d. **5 MFD. 50 v.** ½in. × 1¼in. W. 10d. **8 MFD. 50 v.** ⅝in. × 1¼in. LT. 10d. **8 MFD. 25 v.** ⅝in. × ½in. LT. 10d. **8 MFD. 50 v.** ⅝in. × 1¼in. T. 10d. **10 MFD. 25 v.** ⅝in. × 1in. LT. 10d. **10 MFD. 15 v.** ½in. × 1¼in. LT. 10d. **10 MFD. 25 v.** ½in. × 1¼in. 10d. **10 MFD. 50 v.** ½in. × 1¼in. W. 10d. **12 MFD. 25 v.** ½in. × 1¼in. W. 10d. **12 MFD. 50 v.** ½in. × 1⅝in. T.S. 1/-. **25 MFD. 12 v.** ½in. × 1¼in. LT. 10d. **25 MFD. 25 v.** ½in. × 1¼in. T.S 10d. **25 MFD. 25 v.** ½in. × 1¼in.LTS. 10d. **25 MFD. 50 v.** ½in. × 1¼in. W.-S. 10d. **25 MFD. 3 v.** ⅜in. × ½in. LT. 10d. **50 MFD. 6 v.** ⅝in. × 1in. LT. 1/-. **50 MFD. 12 v.** ½in. × 1¼in. LT. 10d. **50 MFD. 70 v.** ½in. × 1¼in. T. 1/-. **100 MFD. 12 v.** ½in. × 1¼in. T.S. 10d. **100 MFD. 50 v.** ⅝in. × 1⅝in. W. 1/-. **200 MFD. 6 v.** ½in. × 1in. LT. 1/-. **200 MFD. 25 v.** ½in. × 1¼in. T. 10d. **200 MFD. 35 v.** 1in. × 1¼in. T.S. 10d. **250 MFD. 12 v.** ½in. × 1¼in. W.-S. 1/-. **250 MFD. 6 v.** 1in. × 2in. T.S. 1/-. **250 MFD. 25 v.** ½in. × 1¼in. W.-S. 1/-. **250 MFD. 50 v.** 1in. × 1⅞in T. 1/6. **400 MFD. 6 v.** ½in. × 1¼in. T. 10d. **350 MFD. 12 v.** ½in. × 1¼in. W. 1/-. **500 MFD. 6 v.** 1in. × 2in. C. 9d. **500 MFD. 12 v.** ½in. × 1⅝in. T. 10d. **500 MFD. 12 v.** ½in. × 1¼in. W. 1/-. **500 MFD. 6 v.** ½in. × 1¼in. T. 10d. **500 MFD. 25 v.** 1in. × 1¼in. T.W.S. 1/6. **500 MFD. 25 v.** 1in. × 2in. T. 1/-. **1,000 MFD. 6 v.** 1in. × 2in. T. 2/-. **1,000 MFD. 12 v.** 1in. × 2in. T. 2/-. **1,000 MFD. 25 v.** 1in. × 3in. T. 1/6. **2,000 MFD. 12 v.** 1¼in. × 1⅝in. W. 2/-. **3,000 MFD. 25 v.** 1¼in. × 4¼in. C. 4/-. **3,000 MFD. 100 v.** 2½in. × 4¼in. T. 5/-. **4,000 MFD. 6 v.** 1¼in. × 3in. C. 2/6.

1 MFD. 200 v. ⅜in. × 1in. LT. 9d. **1 MFD. 275 v.** ½in. × 1¼in. W.S. 1/-. **2 MFD. 150 v.** ½in. × 1¼in. T. 9d. **2 MFD. 275 v.** ½in. × 2in. T. 10d. **2 MFD. 350 v.** ½in. × 2in. P. 9d. **2 MFD. 350 v.** ½in. × 2in. T.S. 10d. **3 MFD. 600 v.** ½in. × 2in. T. 1/-. **4 MFD. 150 v.** ½in. × 1¼in. T. 9d. **4 MFD. 150 v.** ½in. × 1½in. W. 10d. **4 MFD. 150 v.** ½in. × 1¼in. W.S. 1/-. **8 MFD. 150 v.** ½in. × 1¼in. T. 9d. **8 MFD. 150 v.** ½in. × 1⅝in. W.S. 10d. **8 MFD. 200 v.** ½in. × 1¼in. W.S. 10d. **8 MFD. 450 v.** ½in. × 1¼in. W.S. 1/11. **12 MFD. 450 v.** ½in. × 2in. T.S. 2/-. **16 MFD. 150 v.** ½in. × 1¼in. T.S. 1/-. **16 MFD. 150 v** ½in. × 1⅝in. T. 10d. **16 MFD. 275 v.** ½in. × 2in. T. 1/3. **16 MFD. 350 v.** ½in. × 2in. P. 1/6. **16 MFD. 450 v.** 1in. × 2in. T.S. 2/-. **20 MFD. 450 v.** 1in. × 2½in. P.S. 1/9. **20 MFD. 450 v.** ½in. × 2in. T. 2/-. **24 MFD. 275 v.** ½in. × 2in. T.S. 1/6. **32 MFD. 150 v.** ½in. × 1¼in. T. 1/-. **32 MFD. 275 v.** 1in. × 2in. P. 1/6. **32 MFD. 275 v.** 1in. × 2in. T. 1/9. **32 MFD. 350 v.** 1in. × 2in. W. 2/-. **32 MFD. 450 v.** 1¼in. × 2in. W.S. 2/6. **40 MFD. 150 v.** 1in. ×2in. P. 1/-. **40 MFD. 150 v.** 1in. × 2in. T.S. 1/3. **40 MFD. 350 v.** 1in. × 2in. P. 2/-. **40 MFD. 350 v.** 1in. × 2in. T. 2/3. **40 MFD. 450 v.** 1in. × 3in. W.S. 2/9. **40 MFD. 450 v.** 1in. × 2in. P. 2/6. **50 MFD. 150 v.** 1in. × 2in. T. 1/-. **50 MFD. 275 v.** 1in. × 2in. P.S. 2/-. **50 MFD. 350 v.** 1. × 2. W.S. 2/3. **50 MFD. 450 v.** 1in. × 3in. P. 2/6. **64 MFD. 275 v.** 1in. × 3in. P. 2/6. **64 MFD. 350 v.** 1in. × 2in. P. 3/-. **100 MFD. 275 v.** 1¼in. × 2in. T.S. 2/6. **100 MFD. 275 v.** 1in. × 3in. C. 2/6. **100 MFD. 300 v.** 1in. × 3in. T. 2/9. **100 MFD. 350 v.** 1¼in. × 3in. C.S. 3/-. **200 MFD. 250 v.** 1¼in. × 3in. C.S. 2/-. **250 MFD. 150 v.** 1¼in. × 3in. P. 1/3. **8+8 MFD. 450 v.** ½in. × 1¼in. W.S. 3/-. **8+8 MFD. 350 v.** 1in. × 2in. T. 2/6. **8+8 MFD. 350 v.** 1in. × 1½in. T.S. 2/9. **8+8 MFD. 500 v.** 1¼in. × 2in. T. 3/6. **8+16 MFD. 275 v.** 1in. × 2in. P. 2/9. **8+16 MFD. 450 v.** 1in. ×2in. T.S. 3/-. **8+16 MFD. 450 v.** 1in. × 1¼in. W.S. 3/6. **16+16 MFD. 450 v.** 1in. × 2in. T.S **3/6. 16+16 MFD. 450 v.** 1in. × 2in. W.S. 4/-. **16+32 MFD. 275 v.** 1in. × 2in. T. 2/6. **20+10 MFD. 450 v.** 1in. × 3in. C. 3/-. **20+20 MFD. 150 v.** 1in. × 2in. W. 2/-. **20+20 MFD. 350 v.** 1¼in. × 2in. W. 3/-. **24+24 MFD. 275 v.** 1in. × 2in. T. 2/6. **24+24 MFD. 350 v.** 1¼in. × 2in. T. 3/-. **32+16 MFD. 275 v.** 1in. × 2in. T. 2/6. **32+16 MFD. 350 v.** 1¼in. × 2in. T. 3/6. **32+32 MFD. 150 v.** 1in. × 2in. T. 2/-. **32+32 MFD. 275 v.** 1¼in. × 2in. P. 2/9. **32+32 MFD. 350 v.** 1¼in. × 3in. C.S. 3/6. **40+40 MFD. 150 v.** 1in. × 3in. P. 1/6. **40+40 MFD. 150 v.** 1in. × 3in. T. 2/-. **40+40 MFD. 150 v.** 1in. × 2in. W.S. 2/6. **40+40 MFD. 275 v.** 1¼in. × 2in. C. 2/9. **40+40 MFD. 450 v.** 1¼in. × 3in. P. 3/-. **50+50. MFD. 150 v.** 1in. × 2in. T. 2/-. **50+50 MFD. 275 v.** 1¼in. × 3in. C. 2/9. **50+50 MFD. 300 v.** 1in. × 3in. T. 3/-. **50+50 MFD. 300 v.** 1¼in. × 2in. T. 3/-. **50+50 MFD. 350 v.** 1¼in. × 3in. T. 3/6. **60+100 MFD. 275 v.** 1¼in. × 3in. C. 4/-. **60+100 MFD. 350 v.** 1¼in. × 4¼in. T. 6/-. **50+250 MFD. 250 v.** 1¼in. × 4¼in. C. 4/-. **60+250 MFD. 275 v** 1¼in. × 4¼in. T. 5/6. **80+50 MFD. 150 v.** 1in. × 2in. W.S. 2/-. **100+65 MFD. 350 v.** 1¼in. × 3in. P. 4/-. **100+100 MFD. 350 v.** 1¼in. × 2in. T. 6/-. **100+200 MFD. 250 v.** 1¼in. × 4¼in. C. 4/6. **100+200 MFD. 275 v.** 1¼in. × 4¼in. C. 5/6. **100+200 MFD. 350 v.** 2in. × 4¼in. T. 6/-. **100+400 MFD. 275 v.** 1¼in. × 4¼in. C. 5/6. **125+200 MFD. 275 v.** 1¼in. × 4¼in. C. 5/6. **150+200 MFD. 350 v.** 1¼in. × 4¼in. C. 6/-. **200+200 MFD. 275 v.** 1¼in. × 4¼in. C. 5/6. **1,000+1,000 MFD. 6 v.** 1in × 3in. C. 3/-. **8+8+8 MFD. 350 v.** 1in. × 2in. T. 4/6. **12+12+24 MFD. 275. v.** 1in. × 2in. P. 3/-. **16+8+4 MFD. 275 v.** 1in. × 2in. P. 2/-. **18+16+16 MFD. 275** 1in. × 2in. P. 3/-. **16+32+32 MFD. 275 v.** 1in. × 3in. C. 3/6. **20+10+10 MFD. 275 v.** 1in. × 2in. P. 3/-. **20+20+20 MFD. 150 v.** 1in. × 2in. P. 2/-. **25+25+25 MFD. 25 v.** 1in. × 2in. T.S. 1/6. **30+25+20 MFD. 150 v.** 1¼in. × 2in. C.S. 2/-. **32+32+2 MFD. 275 v.** 1¼in. × 2in. C 2/6. **32+32+8 MFD. 275 v.** 1in. × 3in. 3/-. **32+24+24 MFD. 350 v.** +16 MFD. 200 v. 1¼in. × 3in. C. 4/-. **40+20+10 MFD. 350 v.** 1in. × 3in. P. 3/6. **40+20+70 MFD. 150 v.** 1in. × 2in. T.S. 2/6. **40+20+20 MFD. 450 v.** 1¼in. × 3in. T.S. 4/6. **40+30+20 MFD. 275 v.** 1¼in. × 3in. P. 3/6. **40+40+20 MFD. 275 v.** 1in. × 3in. T. 3/-. **40+40+20 MFD. 350 v.** 1¼in. ×3in. P. 4/-. **50+50+50 MFD. 350 v.** 1¼in. × 3in. P. 3/6. **100+250+250 MFD. 275 v.** 2in. × 4¼in. C. 6/- **200+200+250 MFD. 275 v.** 2in. × 4¼in. C. 6/6. **500+500+500 MFD. 275 v.** 2½in. × 4¼in. T. 15/-

ALL VOLTAGES QUOTED ARE WORKING VOLTAGES

SUB MINIATURE ELECTROLYTIC CONDENSERS.
2 MFD., 6 MFD., 8 MFD., 10 MFD., 16 MFD., 30 MFD. 2 v. or 6 v. Size: ⅛in. × ⅞in. **16 MFD. and 30 MFD.** ¼in. × ¾in. **PRICE 2/9 each.**

MINIATURE BIAS CONDENSERS
25 MFD. 25 v. 50 MFD. 12 v. 50 MFD. 25 v. Size: ⅜in. × ⅞in. **Price 1/6 each.**
25 MFD. 50 v. Size: ½in. × 1¼in. **1/9 each.**

SUB MINIATURE METALISED PAPER CONDENSERS
Size: ⅜in. × ¾in. **100 v. working.**
.005 MFD., .0022 MFD., .002 MFD., .001 MFD. Price 8d. each.
.01 MFD., .02 MFD. Price 9d. each .04 MFD. Price 10d. each.

MINIATURE MICA CONDENSERS
Price 6d. each. 350 v. wkg. 47 pF., 50 pF., 100 pF., 200 pF., 350 pF., 500 pF., 750 pF., 1,000 pF., 5,000 pF.

SILVER MICA CONDENSERS. PRICE 4d. EACH
1 pF., 2 pF., 5 pF. 8.2 pF., 15 pF., 20 pF., 22 pF., 27 pF., 30 pF., 40 pF., 50 pF., 60 pF., 65 pF., 75 pF., 100 pF., 150 pF., 200 pF., 220 pF., 240 pF., 300 pF., 320 pF., 350 pF., 375 pF., 420 pF., 617 pF., 1,200 pF., 1,500 pF., 2,200 pF., 3,300 pF., 18,000 pF., 27,000 pF. 1% and 2%. 1% and 2%. Price 6d. each.
60 pF., 75 pF., 85 pF. 90 pF., 100 pF., 125 pF., 141 pF., 145 pF., 175 pF., 180 pF., 184 pF., 240 pF., 300 pF., 350 pF., 381 pF., 400 pF., 456 pF., 540 pF., 565 pF., 2,700 pF.

CERAMIC CONDENSERS. PRICE 6d. EACH
1 pF. 1.5 pF. 2 pF. 3.3 pF. 4 pF. 5 pF. 6.8 pF. 8.2 pF. 10 pF. 12 pF. 15 pF. 16 pF. 18 pF. 22 pF. 25 pF. 30 pF. 33 pF. 35 pF. 39 pF. 47 pF. 50 pF. 56 pF. 60 pF. 68 pF. 70 pF. 80 pF. 100 pF. 120 pF. 150 pF. 220 pF. 250 pF. 1,000 pF. 2,000 pF.

DISC CERAMIC CONDENSERS 500 V. Wkg. PRICE 6d. EACH.
.001 MFD., .0025 MFD., .002 MFD. .003 MFD., .005 MFD., .01 MFD. PRICE 9d. each.

ERIE FEED THROUGH CONDENSERS
100 pF. 6d. each. 1,000 pF. 6d. each.

HIGH VOLTAGE SILVER MICAS
100 pF., 5 kV. working. 300 pF 8 kV. Test. Price 9d. each.

VARIABLE GANG-CONDENSERS
Twin Gang. 20 pF. Ideal for F.M. 2in. × 1¼in. × 1in., **2/- each.**
Twin Gang. .0005 MFD. 2¼in. × 2in. × 1¼in. Spindle ¼in., **4/- each.**
Min. Twin Gang. .0005 MFD., 2¼in. × 1¼in. × 1¼in. Spindle ¼in., **5/6 each.**
Min. Twin Gang. .0005 MFD. 2¼in. × 1¼in. × 1¼in. Spindle ¼in. with trimmers **6/6 each.**

METALISED PAPER TUBULARS
T.C.C. .02 MFD. 350 v.w. 8d. Dubilier. **.05 MFD. 350 v.w. 9d.** Hunts. **.05 MFD. 500 v.w 9d.** Dubilier. **.1 MFD. 150 v. 4d. .1 MFD. 500 v.w. 9d.**

WIRE WOUND RESISTORS
5 watt Size ⅝in. × 1¼in. **Price 10d. each.**
7 Ω., 7.5 Ω. 8 Ω., 10 Ω., 12 Ω., 15 Ω., 20 Ω., 22 Ω., 24 Ω., 27 Ω., 30 Ω., 33 Ω., 34 Ω., 36 Ω., 39 Ω., 41 Ω., 43 Ω., 45 Ω., 47 Ω., 50 Ω., 51 Ω., 52 Ω., 54 Ω., 55 Ω., 56 Ω., 60 Ω., 64 Ω., 66 Ω., 67 Ω., 68 Ω., 70 Ω., 75 Ω., 80 Ω., 82 Ω., 110 Ω., 136 Ω., 150 Ω., 160 Ω., 170 Ω., 180 Ω., 200 Ω., 220 Ω., 250 Ω., 270 Ω., 300 Ω., 320 Ω., 330 Ω., 375 Ω., 400 Ω., 430 Ω., 470 Ω., 500 Ω., 560 Ω., 600 Ω., 630 Ω., 680 Ω., 800 Ω., 820 Ω., 940 Ω., 1 K., 1.1 K., 1.3 K., 1.4 K., 1.6 K., 1.7 K., 1.8 K., 2 K., 2.2 K., 2.4 K., 2.5 K., 2.7 K. 3.3 K., 4.5 K., 4.7 K., 5 K. 5.2 K., 5.6 K., 5.9 K., 6 K. 6.2 K., 6.5 K., 6.8 K., 7 K. 8.5 K., 9 K., 10 K.

6 watt Size: ⅝in. × 1¼in. **Price 1/- each.**
47 Ω., 85 Ω., 100 Ω., 200 Ω., 250 Ω., 260 Ω., 300 Ω., 350 Ω., 400 Ω., 470 Ω., 500 Ω., 560 Ω., 680 Ω., 1 K., 1.6 K., 1.8 K., 1.9 K., 2 K. 2.7 K., 3 K., 3.3 K., 4.3 K., 4.7 K., 5.1 K., 5.6 K., 6.2 K. 6.4 K., 6.8 K. 11 K. 13 K. **14.5 K.**

7 watt Size ⅞in. × 1¼in. **Price 1/- each**
10 Ω., 12 Ω., 20 Ω., 22 Ω., 29 Ω., 33 Ω., 45 Ω., 50 Ω., 55 Ω., 57 Ω., 60 Ω., 150 Ω., 220 Ω., 270 Ω., 330 Ω., 390 Ω., 470 Ω., 600 Ω. 620 Ω., 680 Ω., 800 Ω., 820 Ω., 1 K., 1.6 K., 1.8 K., 3 K., 3.3 K., 3.7 K., 3.8 K., 4.3 K., 4.7 K., 5 K., 7 K., 11 K., 12.5 K. 13 K., 14 K., 15 K., 17 K.

HIGH STABILITY RESISTORS
1½ watt, ½ watt, ¼ watt, 1 watt, 1%, 2%, 5%. Price 1% **10d.** 2% **8d.** 5% **6d.** Please send lists first.

CERAMIC AND CARBON RESISTORS
½, ¼, ½ watt, **3d. each.** 5% **4½ each.** 1 watt. **4d. each.** 2 and 3 watts, **5d. each.** Please send lists first.

MAINS DROPPERS
.3 amps., .2 amps., .15 amps., .1 amps. Price 2/6 each.
LARGE VARIETY IN STOCK

T.V. COMPONENTS
34 Mc/s. I.F. Transformers. Size ½ × ½ × 2½. **1/6.**
38 Mc's. I.F. Transformers. Size ½ × ½ × 2½. **2/-**
Frame Output Transformers. Wide angle, **6/- each.**
Focus Magnets. Adjustable for 14in. tetrode **6/- each.**
Choke. 2 Henries. 60 m/a. 250 ohms. **3/11 each.**
Choke. 1.9 Henries. 230 m/a. **2/11 each.**
Choke 1.3 Henries. 150 m/a.. **2/6 each.**

FOR CALLERS ONLY

FERRITE RODS
5in. × ½in., **10d. each.** 8in. × ½in., **1/3 each.** 4in. × ½in., **10d. each.** 5in. × ⅝in., **1/- each.** 6in. × ⅝in., **1/3 each.** 8in. × ⅝in., **1/6 each.** 3in. × ¾in., **1/- each.** 5in. × ¾in. **1/6 each.** 6in. × ¾in., **1/9 each.** 9in. × ¾in., **2/3 each.** 4in. × 1in., **1/- each.** 5in. × 1in. **1/6 each.** 8in. × 1in., **2/6 each.** 9in. × 1in. oval **2/- each.** 8in. × 1in. × ¼in. **2/- each.**
T.V. Masks. 14in. Tube. **3/- each.**
P.M. Speakers. 5in. 3 ohm **15/- each.**
M.W. Frame Aerials on alloy plate **1/6 each.**
Aluminium Sheet all sizes in stock.

SWITCHES ROTARY
Size 1 ⅛in. dia. 2in. spindles. **Price 2/11 each.**
1 pole 10 way. 1 pole 12 way. 2 pole 2 way. 2 pole 3 way. 2 pole 4 way. 2 pole 5 way. 2 pole 6 way. 3 pole 3 way., 3 pole 4 way. 4 pole 3 way.

VALVE HOLDERS
4 pin Brit. Pax. 2d. each. 5 pin Brit. Pax. 2d. each. 7 pin Brit. Pax. 3d. each. 7 pin Brit. Amp. 4d. each. 7 pin Brit. Cer. 4d. each. Int. Octal Pax. 3d. each. Mazda Octal Pax. 3d. each. Octatab Amp. 6d. each. B7G Pax. 6d. each. B7G P.T.F.E. 9d. each. B7G. Cer. 10d. each. B7G Cer. with saddle and valve retaining spring 1/- each. B7G Cer. with skirt, 10d. each. B8A Pax. 4d. each. B8A amp., 6d. each. B8A Cer. 8d. each. B9A Pax. 6d. each. B9A amp. 8d. each. B9A amp. with skirt 10d. each. B9A Cer. 10d. each. B9A Cer. with saddle and valve retaining spring 1/- each. B9A ceramic with skirt 1/- each. B8A printed circuit 1/-.
When ordering valve holders with valve retaining springs state whether short, med. or long. springs required.

POTENTIOMETERS CARBON
Less Switch. Dia. 1in., 2¼in. spindles 5 K., 10 K., 25 K., 50 K. 100 K., 250 K., 500 K., 1 Meg., 2 Meg., **2/6 each.**
With D.P. Switch Dia. 1in., 2¼in. spindles. 5 K., 10 K., 25 K., 50 K., 100 K. 250 K., 500 K., 1 Meg., 2 Meg. **4/6 each.**

A.V. Pre-set Controls with knurled knob and 6 BA fixing dia. **25 K. 50 K. 100 K. 250 K. 500 K. 1/3 each.**
25 K. wire wound, **1/6 each.**

PRESET TRIMMERS T.V. TYPE
With knurled knob and 6 BA fixing 450 pF. 750 pF. 1,000 pF. 1/6 each.

METAL RECTIFIERS
G.E.C., 250 v. 250 m/a T.V. Price **10/- each.**
Westinghouse, 16 R.D. 2.2.S.1. **7/- each.**
Westectors W.X.6. **1/- each.**

METERS
0-50 m/a. 2in. square, **7/6 each.**
350 m/a. Thermo Couple. 2in. round plug mounting. **2/6 each.**

CHOKES
Choke L.F. Parmeko. 8 Henries 100 m/a.. 6/6.
Choke H.F. 2 pie or 3 pie, **4d. each.**
Choke L.T., 4d. each.
Choke H.F. T.V. type, 3d. each.

MISCELLANEOUS
Vibrator Transformers, 6 v. or 12 v. **7/6 each.**
Vibrators. Plessey 6 8R78DT. 8yn., **7/6 each.**
Perspex Sheet. Tinted. Size. **3/- each.**
Bull Dog Clips, 9d. each.
Co-Axial Cable. Semi air spaced, **8d. yd.**
Double Pole Toggle Switches, 1/- each.

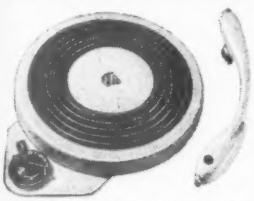
S.A.E. with all enquiries please. All orders received, despatched the same day.

ALL ARTICLES ADVERTISED ARE BRAND NEW AND CARRY OUR USUAL GUARANTEE.
PLEASE STATE IF THE NEAREST VALUE COMPONENT WILL SUIT, SHOULD THE ONE ORDERED BE OUT OF STOCK.
WE HAVE MANY OTHER ITEMS FAR TOO NUMEROUS TO LIST. WHY NOT PAY US A VISIT WHEN IN TOWN? IT WILL PAY YOU.
TERMS OF BUSINESS. CASH WITH ORDER OR C.O.D. ALL ORDERS MUST INCLUDE A REASONABLE AMOUNT TO COVER PACKING AND POSTAGE.

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS

LASKY'S RADIO

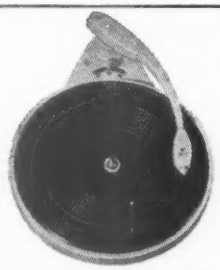
SINGLE PLAYERS



Collaro "Junior" 4-speed motor and pick-up with HGP59 cartridge. **92/6**
Post free.

Motor only, **59/6**, post 2/6.
Pick-up only, **29/6**, post 2/6.

B.S.R. TU9, 4-spd. motor and latest B.S.R. "ful-fi" p.u. **94/-**.
Post 3/6.



Collaro 4/564 4-speed Single Player with Studio T or O p.u. crystal cartridge and styli. Automatic stop.
LASKY'S PRICE Carr. 5/- **£6.19.6**

AUTO-CHANGERS

See us for your requirements or send for our latest list.

COLLARO 4-SPEED MIXER AUTO-CHANGERS

Incorporating auto and manual control. Complete with Studio crystal p.u. and sapphire stylus.
RC.456. List £13/17/-.
LASKY'S PRICE **£7.19.6**

Latest model **RC.457** (Continental). Post 3/6. **£8.19.6**

Immediate Delivery from stock of the COLLARO 4-speed Transcription Turntable
4T200/PX **19/10/-**.
Less pick-up **14/18/-**. Carr. 7/6

BUILD YOURSELF A HIGH GRADE RECORD PLAYER!

We have the biggest selection of Auto-Changers, Single Players, Amplifiers and Cases and you can make your own Record Player for as low as **£10**

TRANSISTORS

Hermetically sealed and unaffected by temperature variations. Tested and guaranteed efficient.

R.F. P.N.P. Junction Type, suitable for medium and low freq. oscillators, freq. changers and I.F. amplifiers (1.5 to 8 Mc/s) **21/-**
(Double spot—yellow and red.)

AUDIO P.N.P. Junction Type, suitable for high gain and low freq. amplifiers, and for output stages up to 250 milliwatts. **10/-**
(Double spot—yellow and green.)
Post free.

MULLARD TRANSISTORS			
OC70	OC71	OC72	OC16
21/-	21/-	30/-	60/-

BRIMAR TRANSISTORS
TS1 **12/6.** TS2 **12/6.** TS3 **15/-.**
TS4 **27/6.** TP1 or TP2 **40/-.**
TJ1 **15/-.** TJ2 **16/6.** TJ3 **19/6.**

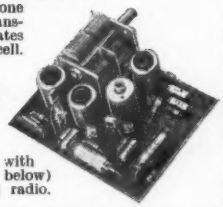
LASKY'S TRANSISTOR SUPERHET TUNER FOR HOME CONSTRUCTION ON PRINTED CIRCUIT

Uses three R.F. Transistors and one Germanium Diode, three I.F. transformers. Ferrite rod aerial. Operates on one 6 v. battery and one 1.5 v. cell. Printed Circuit, 3¾in. × 3¼in.

CAN BE BUILT FOR Post 3/6. **£5.12.9**

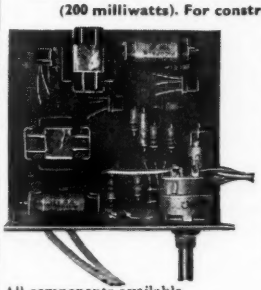
Full details and illustrations post free on request.
Demonstrations at both addresses.

NOTE:—This Tuner in conjunction with our Transistor Amplifier (see below) makes an excellent Transistorised radio. Cabinets available.



LASKY'S TRANSISTOR AMPLIFIER KIT

(200 milliwatts). For construction on a Printed Circuit



All components available separately

Size: 3¾in. × 3¼in. Height can be under 1in. Uses our new hermetically sealed Transistors and operates from 6-volt battery. Output impedance 3 ohms.

FULL DETAILS, CIRCUIT DIAGRAM AND SHOPPING LIST 1/- post free.

COMPLETE KIT including 4 Transistors, all brand new components, latest T.C.C. miniatur condensers, printed circuit and full instructions, **79/6** Post 3/6.

DEMONSTRATIONS AT EITHER OF OUR ADDRESSES

THE GREATEST OFFER OF 4-SPD. MIXER AUTO-CHANGERS EVER MADE!

THE STARR GALAXY

LISTED AT £12

LASKY'S PRICE

79/6 Post 3/6. Brand new and unused in maker's original cartons.

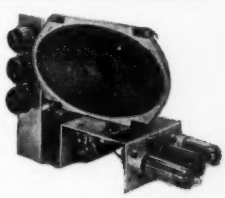
Of modern design and smart duo-tone finish, complete with crystal pick-up with styli. Incorporates auto and manual control with fingertip stop, start and speed change. For A.C. 200-250 v. Offered by Lasky's Radio at ONE-THIRD LIST PRICE! Send today for the biggest bargain in 4-spd. Auto-Changers ever offered!

READY SOON!

LASKY'S FULLY TRANSISTORISED PORTABLE FOR HOME CONSTRUCTION

Note these Star features.
★ Unit construction on Printed Circuit.
★ 200 milliwatts push-pull output.
★ Uses 7 Transistors and 1 germanium diode.
★ Ferrite rod aerial.
★ Fully tunable.
★ Uses one 6 v. and one 1½ v. battery with very low consumption.
★ Choice of 7 × 4 elliptical or 3½in. P.M. Speaker.
★ Choice of cabinet.
★ Most important—a keen price!

Send for full details.



LASKY'S 4-WATT PORTABLE GRAM AMPLIFIER

Will suit any type of crystal or magnetic pick-up. Uses 3 valves: EL84 output, L63 and EZ80 rect. Speaker and controls are completely separate and can be mounted as shown or on anywhere in cabinet where most suitable.

COMPLETE with 3 valves and knobs, less Speaker Carr. 5/- **79/6**

7in. × 4in. Elliptical Speaker, if required, **19/6** extra.

Details and circuit diagram post free on request.

LASKY'S PORTABLE GRAM AMPLIFIER KIT

2 watts. Note small dimensions, approx. 6½in. × 3¾in. max., height 5in. Uses EL84 output and 6X4 rectifier, double-wound transformer tone control, output transformer, etc. Built on a T.C.C. PRINTED CIRCUIT which greatly simplifies construction. Owing to the great demand we have been able to reduce our price.

COMPLETE KIT, including valves, printed circuit, full instructions, less Speaker. Carr. 2/6. **49/6**

7in. × 4in. Elliptical Speaker, if required, **19/6** extra.

CARTRIDGES

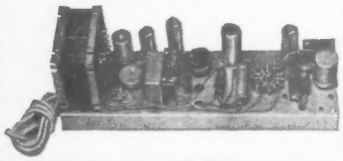
ACOS HGP37 p.u. Cartridges, l.p. and standard, complete with styli. List 41/7.
LASKY'S PRICE Post 1/- **18/-**

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

LASKY'S RADIO

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

SCOOP! — PORTABLE TAPE RECORDER AMPLIFIERS



Mains 200/250 v. A.C. 6 watts output, 4 valves: EZ41 rect., EL41 output, EF40 and ECC81. Tone, volume and record/play back controls. Neon level indicator. Microphone and gram inputs. Can be used as a straight amplifier. Circuit diagram supplied.

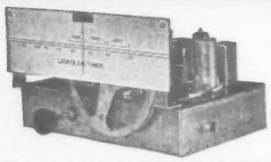
LASKY'S PRICE £6 . 19 . 6

Complete with valves. Post & Pkg. 5/-.

Brand new and unused. Overall size: 14in. long, 4½in. wide, 4½in. high. (Controls are mounted through chassis so cannot be seen in illustration.)

For use with low impedance Tape Heads.

Combined record/play/erase Head available separately, **35/-**. If purchased with Amplifier, **25/-**.



LASKY'S F.M. TUNER

PRINTED CIRCUIT VERSION OF G.E.C. 912 "F.M. PLUS" TUNER FOR HOME CONSTRUCTION

Note these star features:—

★ HIGH SENSITIVITY.
★ ALL BRAND NEW T.C.C. CONDENSERS.
★ AERIAL COIL AND R.F. COUPLING COIL PRINTED ON CIRCUIT.
★ 5 VALVES AND 2 GERMANIUM DIODES.

By the use of a printed circuit the I.F. and R.F. Amplifiers are extremely stable at maximum gain and results are consistent on all tuners.

Valve line-up:—
R.F. Amplifier, Z719 or EF80.
Mixer and Osc. B719 or ECC85.
1st. I.F. amp., W719 or EF85.
2nd I.F. amp., W719 or EF85.
2 Germanium Diodes GEX.34.
Driver Limiter, Z719 or EF80.

Owing to the great demand we have been able to reduce our price.

CAN BE BUILT FOR (including valves) **£7 . 19 . 6**
Post and Pkg. 2/6.

G.E.C. F.M. Tuner Book plus our full data and shopping list 2/6 post free. All parts available separately.

ALIGNMENT SERVICE available.

JASON F.M. TUNER

Special Parcel containing data book, chassis, front panel, dial, drive, tuning condenser, full sets of coils, I.F.s, ratio detector etc. **68/9**
Post 2/6.

DATA BOOK with price list 2/-. This tuner can be built for £6/15/-, post 3/6.

JASON "ARGONAUT"

Super-sensitive Tuner for F.M. and medium waves. Complete parcel with power supplies. **£13 . 19 . 6**
Post 3/6.

DATA BOOK 2/- post free. Chassis Assembly 57/9, post 2/6. I.F. and Coil Set 78/-, post 1/6.
All components available separately.

OTHER F.M. TUNERS

TSL £17/10/-. DULCI £17/10/-. DULCI H4/T 4-wave AM/FM, £20/17/-. Also Quad, Leak, RCA, Rogers, Pamphonic, etc.

HI-FI SPECIALISTS!

Selective Demonstrations of the latest Hi-Fi equipment are given at our Tottenham Court Road showrooms.

PICK - UPS. Garrard, Leak, Connoisseur, Ortophone, B/J., etc., etc.

SPEAKERS. Wharfedale, Goodmans, G.E.C., Lowther, Lorenz, etc., etc.

TRANSCRIPTION TURNTABLES. 3 and 4 speed Garrard, Connoisseur, Collaro, Lenco, etc.

AMPLIFIERS. Quad, Rogers, Leak, RCA, Pamphonic. Unitelex, W.B., etc.

CABINETS. Wide selection of Cabinets and Speaker Enclosures to house your speakers and hi-fi equipment.

MAGNETIC RECORDING TAPE SCOOP!

M.S.S. MASTERTAPE

P.V.C. base on latest type plastic spools. Not surplus but brand new, perfect and boxed. Will work with any Recorder. Limited quantity only. Send now! Satisfaction or money refunded.

1,200ft. Standard on 7in. spool. List 35/-
LASKY'S PRICE 21/-

850ft. Standard on 5½in. Continental spool. List 28/-
LASKY'S PRICE 16/6

600ft. Standard on 5in. pool. List 21/-
LASKY'S PRCIE 12/6

1,200ft. Long Play on 5½in. Continental spool. List 35/-
LASKY'S PRICE 22/6

850ft. Long Play on 5in. spool. List 28/-
LASKY'S PRICE 16/6

Post: 1 spool 1/6. 3 or more, post free.

FAMOUS MAKE BAND III CONVERTER

List £10.17.6
LASKY'S PRICE £5.19.6
Post & Pkg. 5/-.

Brand new in maker's cartons. TUNABLE OVER ALL 13 CHANNELS and incorporates own power supply for 200-250 v. A.C. mains. Metal case 10in. wide, 5½in. deep, 3½in. high, smart fawn enamel finish.

MULLARD 510 AMPLIFIER KIT WITH T.C.C. PRINTED CIRCUIT

All specified components and your choice of transformers and chokes by Partridge, Haddon, W/B, Ellison or Gilson.

COMPLETE KIT of parts and printed circuit as low as **£9.9.0**
Details on request.

Book 3/6 post free.

Printed circuit separately 22/6.

Also available built ready for use. Price according to transformers used.

All components available separately. Price List on request.

DULCI HI-FI CHASSIS, TUNERS and AMPLIFIERS

New designs including:—

Mdl. H.3. AM/FM Radiogram Chassis, 3 wave bands including V.H.F. **£20/17/-**

Mdl. H.4. AM/FM Radiogram Chassis, 4 wavebands, including V.H.F. **£24/6/6**

Mdl. H.4.PP. AM/FM Radiogram chassis, 4 waves including V.H.F. 6-8 watts o.p. push-pull, ultra linear. **£29/3/10**

Mdl. H.11. Combined and self-powered AM/FM Tuner, Control Unit and Audio pre-amplifier. **£29/3/10**

Mdl. DPA.10. 10-14 watt Ultra Linear Power Amplifier ... **£12/12/-**

Mdl. DP.4. 4-watt High Fidelity Amplifier **£7/10/-**

NEW BRENELL MARK IV DECK

Available from stock! This famous Deck entirely redesigned to permit of conversion to stereophonic sound with 4 heads for dual channel operation when required.

DECK only ..... **22 gns.**

LATEST BRENELL HI-FI PRE-AMPLIFIER 17 gns.

COMPLETE MARK IV TAPE RECORDER, as illustrated. Counter 30/- extra ..... **53 gns.**

Come and inspect the new Brenell Mark IV and have a demonstration. Full details post free on request.

TAPE DECKS

All types in stock including the latest model COLLARO "TAPE TRANSCRIPTOR," Mk. III, fitted with digital counter, **£22.**

COLLARO TAPE PRE-AMPLIFIER, fitted and wired. **£21.**

LANE DECK Mk. VI **£18/10/-**

WEARITE DECKS **£35 & £40**

Carr. extra.

TAPE RECORDERS

Grundig, Ferrograph, Elizabethan, Truvox, Sound, Vortexion. Prices from **40 gns.** Also all leading makes of Tape and Spools.

COLLARO TAPE DECK MOTORS, set of 3, clockwise, anti-clock capstan. List **£5/15/-.**

LASKY'S PRICE. 95/-
Post 5/-.

6-12 volt MINIATURE MOTORS

Complete with gearbox. Overall size. 2½in. long × 1¼in. × 1in. Works with any voltage from 6 to 12. Ideal for models, remote control etc. Original cost over **£2.**

LASKY'S PRICE. 12/6
Post 1/6.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

EVERYTHING FOR HOME CONSTRUCTOR & SERVICEMAN

LASKY'S RADIO

TRUVOX 'SENIOR' SPEAKER DRIVING UNIT (pressure type). Power handling cap. 15 watts peak. With 12ft. cinema horn reproduces down to 17 c.p.s. List £7/15/-. Carr. 5/-. Lasky's Price **59/6**

MOVING COIL P.M. SPEAKERS

2½in. 17/6. 3in. and 3½in. 19/6
5in. 16/6, 6½in. 17/6. 8in. 21/-
10in. 29/6. 12in. 29/6
6½in. with transformer 21/-
7×4in. Elliptical..... 19/6
10×7in. Elliptical 32/6

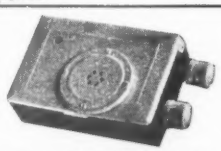
HI-FI ELECTROSTATIC SPEAKERS ('TWEETERS')

LSH75 8/- | LSH518 12/6 | LSH100 14/-
LPH65 (moving coil) 39/6.

15in. DUAL CONCENTRIC SPEAKERS

Famous make, high fidelity, 25 watts, 15 ohms imp.
List £27/4/6. Our price **£16/19/6.**
Full details on request.

SPEAKER COVERINGS. Large stocks of Tygan and "Someweave" Speaker Coverings. Any size piece cut. Send for samples and prices.



TELETRON "COMPANION"
3 - TRANSISTOR POCKET RADIO. T.R.F. circuit covering medium and long waves, with balanced armature output. Ferrite aerial. Note small size: 4½ × 3 × 1in. Can be built for only **89/6**
Full instructions and price list, 6d. post free. All components available separately.

MAKERS' SURPLUS TV COMPONENT BARGAINS

WIDE ANGLE 38 mm.

Line E.H.T. trans., ferrox-cube core, 9-16kV. 25/-
Scanning Coils, low imp. line and frame 25/-
Ferrox-cube cored Scanning Coils and Line Output Trans., 10-15 kV., EY51 winding. Line Trans. Complete with circuit diagram, the pair 50/-
Frame Output Transformer 6/6
Scanning Coils, low imp. line and frame 17/6
Frame or line blocking osc. transformer 4/6
Focus Magnets Ferrox-dure 19/6
P.M. Focus Magnets. Iron Cored .. 19/6
Duomag Focalisers 22/6
300 m/a. Smoothing Chokes 15/-

STANDARD 36 mm.

Line Output Transformers 6.9 kV. E.H.T. and 6.3 v. winding. Ferrox-cube 19/6
Scanning coils. Low imp. line and frame 12/6
Ditto by Igranic 14/6
Frame or line blocking oscillator transformer 4/6
Frame output transformer 7/6
Focus Magnets
Without Vernier 12/6
With Vernier 17/6
200 m/a. Smoothing Chokes 10/6

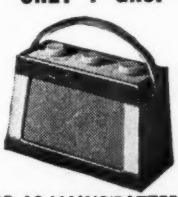
EASILY BUILT RADIO SETS

Size 12 × 6½ × 5½in. deep. Choice of walnut veneer wood cabinet or walnut or ivory plastic cabinet.

PARCEL No. 1
Everything to build a 4-valve 3-wave superhet for 200/250 A.C. mains. Uses 6K8, 6K7, 6Q7, 6V6 valves.
CAN BE BUILT FOR Carr. and packing 2/6. **£7/19/6**

PARCEL No. 2
Everything to build a T.R.F. 3-valve set for 200/250 A.C. mains, medium and long waves. Uses 6K7G, 6J7, 6V6 and metal rectifiers.
CAN BE BUILT FOR Carriage and packing 2/6. **£5/10/0**
INSTRUCTION BOOK for either above sets 1/- post free.
CABINETS ONLY, 17/6. Post 2/6.
All components available separately.

BUILD THIS 4-VALVE S/HET BATTERY PORTABLE FOR ONLY 7 GNS.



OR AS MAINS/BATTERY FOR ONLY 9 GNS.

The **PRINTED CIRCUIT** supplied makes construction amazingly easy and accurate. You can build this fine 4-valve superhet portable in an hour or so, and performance equals ready-built sets costing pounds more!

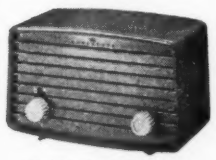
BUILD IT NOW READY FOR SUMMER USE!

FOR ONLY £7/7/- plus 3/6 carr. and pkg., you can build this Portable using all brand new components and valves, only batteries extra. Printed circuit, circuit diagram and full instructions supplied. Circuit diagram and full data 1/6 post free.

FOR ONLY £9/9/- plus 3/6 carr. and pkg. you can build this job as a mains and battery Portable using our specially designed build-it-yourself Power Unit for 200-250 v. A.C.

H.P. TERMS AND CREDIT SALES AVAILABLE

LASKY'S NEW MIDGET T.R.F. CONSTRUCTOR PARCEL



CAN BE BUILT FOR ONLY 99/6
Post & Pkg. 5/-
Handsome contemporary design case, overall size 8½in. wide, 4½in. deep, 5in. high. 2 latest double-purpose valves EBF89 and ECL80, contact cooled rectifier. For A.C. mains 200-250 v. Med. and long wave, 5in. P.M. speaker. Plastic cabinet in cream, pastel green, pink, blue. FULL DATA, instructions, circuit diagram and shopping list, 1/6 post free.
All components available separately.
CABINET only, as illus., 14/- plus 4/6 post and pkg.

BAND III CONVERTERS TURRET TUNERS AERIALS, Co-Ax. CABLE

Very large stocks. We have what you require. Call or write.

CO-AX. CABLE
80 ohms semi-airspaced, finest quality, stranded. Per yard, 9d. Dozen yards 7/6
Post extra. Any length supplied.

17in. C.R. TUBES

Rectangular, aluminised or ion trap 0.3 heater. Brand new and unused. **£12/19/6**
Carr. and Insur. 22/6.

New AVO MULTIMINOR. 19 ranges A.C. and D.C. 10,000 ohms per volt. D.C. 1,000 ohms per volt A.C. Pocket size: 5¾ × 3¾ × 1¾in. Complete £9/10/-. Post 3/6.

BARGAIN OFFER OF POCKET VOLT TEST METERS

Two ranges D.C. 0-250 v. and 0-25 v. Complete with leads in leather case.
LASKY'S PRICE **12/6**
Post free.

CHASSIS
We have the largest stocks of chassis, A.M. and AM/FM. A.M. chassis, l, m, s, from **7 Gns.** AM/FM chassis .....from **14 Gns.**

FERRITE RODS
Large selection of Ferrite Rods, all lengths, in stock. Price, per rod, **2/6** to **3/6.**

MAINS TRANSFORMERS

All 200-250 v. 50 c.p.s. primary, finest quality, fully guaranteed.
MBA/3. 350-0-350 v. 80 mA. 6.3 v. 4 a. 5 v. 2 a. Both filaments tapped at 4 volts. 19/6
MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. 19/6
AT/3. Auto trans. 0-10-120, 200-230-240 v. 100 watts 19/6
M.T./341. Tapped input 250-0-250, 120 mA., 6.3 v. 5 amps., fully shrouded..... 27/6

FILAMENT TRANSFORMERS

All 200-250 v. 50 c.p.s. primary, finest quality, fully guaranteed.
6.3 v. 1.5 amp. 5/11
6.3 v. 3 amp. 9/6
0-30 v. 2 amp. tapped voltages, 19/6

GERMANIUM CRYSTAL DIODES

GEX.00 1/6, GEX.34 3/6, WG5 3/6, GEX. 54 and OA74 5/-, GD3 3/6, GD4 3/6, CG12E 5/-.

SPECIAL RECTIFIER OFFERS

RM.0, 125 v. 30 m/a... 4/11
RM.1, 125 v. 60 m/a... 5/11
RM.2, 125 v. 100 m/a... 6/6
RM.3, 125 v. 120 m/a... 7/6
RM.4, 250 v. 125 m/a... 16/-
RM.5, 250 v. 150 m/a... 21/-
Post extra.
All makes and types in stock. Send to us for your requirements. Prompt service.

20,000 VALVES IN STOCK

Here are a few examples of brand new surplus and imported valves:

EB91	7/6	EY51	10/6	EL84	11/6
EB41	7/6	EF80	10/6	ECF80	15/-
EABC80	10/-	EF85	10/6	EZ40	8/6
EAF42	10/-	EF86	14/-	EZ80	8/6
EBC41	10/-	EF89	10/-	FCL82	12/6
ECC85	10/-	6K8	10/6	PCC84	12/6
ECC84	15/-	6V6	8/6	PL82	10/6
ECC83	9/-	6K7	5/6	PL83	11/6
ECC82	9/-	6Q7	10/6	PY80	10/6
ECC81	9/-	6H7	6/6	PY81	10/6
12AT7	8/6	5Z4	9/6	PY82	10/6
12AU7	8/6	DAF96	10/-	PY83	10/6
12AX7	9/6	DL96	10/-	6AT6	7/6
EB89	10/6	DK96	10/-	6AT7	7/6
EFC82	15/-	DF96	10/-	185	7/6
ECH42	11/6	DM70	9/-	384	9/-
ECH81	11/6	EY51	12/6	1T4	9/-
ECL80	10/6	EC84	11/6	1R5	7/6

Also full stocks of B.V.A. Valves and C.R. Tubes at the new lower list prices.
WRITE FOR COMPLETE LIST

LASKY'S (HARROW ROAD) LTD.

LASKY'S RADIO

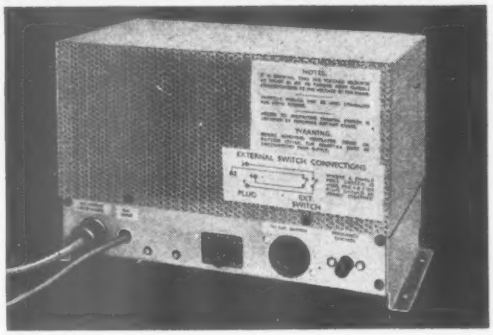
42 TOTTENHAM COURT ROAD, W.1.
Nearest Station Goodge Street
MUSeum 2605.

370 HARROW ROAD, PADDINGTON, W.9.
(Opposite Paddington Hospital)
LAD 4075 and CUN 1979.

Open all day Saturday. Early closing Thursday (both addresses)

ALL MAIL ORDERS TO HARROW ROAD PLEASE

have you a DC 'bug-bear'?



No longer need D.C. current be a 'bug-bear'. The Felgate ELECTRONIC INVERTER will transform 200/250 volt D.C. current to operate almost any A.C. apparatus needing a power of between 25 and 78 watts.
The instrument consists of a hard valve push-pull power amplifier driven by a separate oscillator; there are no moving parts. It is silent in operation and its frequency is very stable. Measuring 9¼" x 6¼" x 5¼" it can be fixed inside a large instrument such as a radiogram, with control switch on the dial.
PRICE £13. (no P.T.)

FELGATE
electronic inverter

See your dealer today. If any difficulty write to:
FELGATE RADIO LTD. FELGATE HOUSE, STUDLAND STREET, HAMMERSMITH, W.6.

20

CREDIT SCHEME NOW WORKING

CR50 BRIDGE measures 10pFd to 100mFd and 1 ohm to 10 Megohms in fourteen ranges. Leakage test for condensers. Mains operated. Complete with instructions. **£8/2/6** plus 4/6 carr./packing or **£1** deposit and 32 weekly payments of 5/-.

SG50 SIGNAL GENERATOR covers 100kc/s to 80Mc/s in six ranges on fundamentals. A de luxe instrument for only **£9** plus 6/- carr./packing or **£2** deposit and 32 weekly payments of 5/-.

VV50 VALVE VOLTMETER measures up to 250 volts D.C., A.F. and R.F. Price **£8/2/6** plus 4/6 carr./packing or **£1** deposit and 32 monthly payments of 5/-.

Further details of the above sent by return of post on receipt of self addressed envelope.

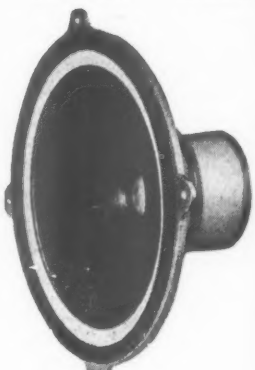
TRADE supplied direct. CALLERS always welcome.

GRAYSHAW INSTRUMENTS
126 Sandgate High Street, Folkestone, Kent
Phone: Folkestone 78618

BAKERs 'Selhurst' RADIO
DINGWALL ROAD, CROYDON, SURREY

The full range

"ULTRA 12"



£17 . 10 . 0

20-25000 c/s.

Foam Suspension — Smooth clean Bass
Aluminium Drive — Bright clear treble
High Flux Magnet Definition & Realism

Sales Demonstrations and Offices

JOHN LIONNET & COMPANY
17 CHARING CROSS ROAD, LONDON, W.C.2. Tel: TRAfalgar 5575
Trade & Export Inquiries Invited

AND NOW THERE ARE TWO

Stern's "fidelity" TAPE RECORDERS

PRICE . . . Including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

£49.10.0 (OR £3 EXTRA WITH REV. COUNTER)

CREDIT SALE: Deposit £12/8/- and 9 monthly payments of £4/10/8.
HIRE PURCHASE: Deposit £24/15/- and 12 monthly payments of £2/5/11.

IT INCORPORATES: The NEW TRUVOX Mk. IV TAPE DECK together with the "fidelity" MODEL HF/TR2 TAPE AMPLIFIER (both fully described on this page), and a Rola 10in. x 6in. P.M. speaker.

PRICE . . . Including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

"JUNIOR"

39GNS.

CREDIT SALE: Deposit £10/5/- and 9 monthly payments of £3/15/2.
HIRE PURCHASE: Deposit £20/10/- and 12 monthly payments of £1/18/-.

IT INCORPORATES: THE TRUVOX MK. III TAPE DECK together with correctly matched HF/TR1A TAPE AMPLIFIER and a 7in. x 4in. Speaker.

(Plus £1/10/- carriage and insurance, of which £1 is refunded on return of Packing Case.)

BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THESE MODELS—TRULY "Hi-Fi" RECORDINGS ARE OBTAINABLE and they are comparable to much higher-priced Recorders.

Alternatively send S.A.E. for ILLUSTRATED LEAFLET

THE NEW TRUVOX Mk. IV TAPE DECK

ONE OF THE BEST DECKS ON THE MARKET

PRICE £27.6.0 (Plus 10/- carr. and ins.)

CREDIT TERMS: Deposit £6/17/- and 9 monthly payments of £2/10/-.
H.P. TERMS: Deposit £13/13/- and 12 monthly payments of £1/5/4.

SPECIFICATION:— ● 3 B.T.H. shaded pole motors with silent friction drive eliminating wow and flutter. ● Push-button controls, electrically and mechanically interlocked (patented). ● Patented electric-type push-button controlled brake. ● Inching to assist editing; tape loading on the drop-in principle; accommodation for reels of 7in. diameter. ● Tracking screw. To British and American standards. ● Playing times: Up to 3 hours with L.P. Tape or 2 hours with Standard Tapes. ● Two tracks side by side, with safety gap. ● Playing time indication by precision revolution counter of large visual type indicator plate, according to choice. Positive Azimuth adjustment of Record/Player Head. ● High Impedance Heads. ● The metal work is Gold Hammered finish. ● Overall size 14½in. × 12$\frac{15}{16}$in., from top of face of panel overall depth 5in.

The Mk. IV DECK CAN ALSO BE SUPPLIED INCORPORATING PRECISION REV. COUNTER for £30/9/-. **H.P. TERMS:** Deposit £15/4/6 and 12 months of £1/8/3.

CREDIT SALE: Deposit £7/12/3 and 9 months of £2/15/10.

A COMPLETE KIT OF PARTS TO BUILD
The "fidelity" TAPE AMPLIFIER Model HF/TR2 including POWER SUPPLY UNIT

FOR ONLY £12.0.0 (Plus 5/- carr. and ins.)

This amplifier has been expressly designed to meet the requirements of the enthusiasts for High Fidelity reproduction. It is based on the very successful design, completed by the Mullard Technicians and only really high-grade components are incorporated; truly HIGH FIDELITY Recordings are obtainable whilst "Hi-Fi" reproduction is assured by use of a high-quality Output Transformer by Gilson. It incorporates a "magic eye" Recording Level indicator, a two-position equaliser for 3¾in. and 7½in. speeds, and an effective Tone Control arrangement. Monitoring and Extension Speaker Socket are incorporated and in addition a position is provided to enable it to be used as an independent Amplifier for Gramophone Records or Radio Tuning Unit. Overall size: 11in. × 6in. × 6in. high. Suitable for nearly all makes of Tape Decks. **When ordering, please advise make of deck in use.**

THE ASSEMBLY MANUAL PRACTICAL DIAGRAMS, etc., are available for 2/9 or send S.A.E. for brief details.

WE ALSO SUPPLY THE HF/TR2 ASSEMBLED AND READY FOR USE FOR £16.0.0 (Plus 6/- carr. and ins.). **H.P. TERMS:** Deposit £8 and 9 monthly payments of £1. **CREDIT TERMS:** Deposit £4 and 9 monthly payments of £1/9/4.

HOME CONSTRUCTORS

BUILD YOUR OWN RECORDER . . . WE OFFER

(a) The model **HF/TR2 AMPLIFIER** and **POWER UNIT**, both fully assembled, together with the TRUVOX MK. IV TAPE DECK for..... £38 10 0
ALTERNATIVELY as above but the HF/TR2 Amplifier and P/Unit as a COMPLETE KIT OF PARTS £35 0 0

(b) The model **HF/TR2 AMPLIFIER** and **POWER UNIT** both fully assembled, together with the TRUVOX TAPE DECK incorporating PRECISION REV. COUNTER £41 10 0
ALTERNATIVELY as above but the HF/TR2 Amplifier and P/Unit as a COMPLETE KIT OF PARTS £38 0 0

(c) The model **HF/TR2 AMPLIFIER** and **POWER UNIT**, both fully assembled, together with the COLLARO TRANSCRIPTOR £35 0 0
ALTERNATIVELY as above but the HF/TR2 Amplifier and P/Unit as a COMPLETE KIT OF PARTS £31 10 0

plus 12/6 carriage and insurance.

TO COMPLETE THE RECORDER . . . WE OFFER

The Portable Carrying Case . . . Acos
Crystal Mike . . . Rola 10in. × 6in. P.M. SPEAKER . . . 1,200ft. Plastic Tape.

ALL FOR **£8.10.0** (plus 7/6 Carr. & Ins.)

STERN'S TAPE PRE-AMPLIFIER and ERASE UNIT

Provides the 'Link' between the HIGH-QUALITY AMPLIFIER & TAPE DECK

MODEL HF/TR1P . . . A completely assembled Pre-Amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks, and incorporates Recording Level Indicator and Monitoring facilities.
Please send S.A.E. with any inquiry.

PRICE **£11.10.0** (plus 5/- carr. and insurance)

WE MAKE SPECIALLY REDUCED PRICES FOR COMBINED ORDERS

ADD TAPE TO YOUR EXISTING AMPLIFIER . . . *WE OFFER YOU*

(a) The Model **HF/TR1P TAPE PRE-AMPLIFIER** together with the TRUVOX MK. IV TAPE DECK £35 0 0
(b) ALTERNATIVELY as in (a) above but Truvox Deck incorporating PRECISION REV. COUNTER £38 0 0
(c) The model **HF/TR1P TAPE PRE-AMPLIFIER** together with the COLLARO TRANSCRIPTOR Tape Deck £31 10 0

PLEASE INCLUDE 12/6 to cover cost of carriage and insurance.

HIRE PURCHASE and **CREDIT SALE TERMS** are available on all equipment (excluding Kits of Parts). Send S.A.E. for details.
NOTE . . . The Collaro Transcriptor is in short supply and there may be a delay in delivery. We will however book an order
The Deck switches of the Transcriptor have to be "wired-up." We will complete this wiring, for use with either the HF/TR2 or the HF/TR1P, for an extra charge of £1.

Open Monday to Friday 9 a.m.—6 p.m. Saturday 9 a.m.—1 p.m.

STERN RADIO LTD.

(DEPT 109/W)

109 & 115 FLEET ST., LONDON, E.C.4

Telephone: FLEet St. 5812/3/4

IT'S MUCH BETTER

MODERNISE YOUR OLD RADIOGRAM

IT'S MUCH CHEAPER

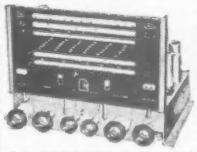
THE NEW ARMSTRONG P.B.409 AM/FM RADIOGRAM CHASSIS

PRICE **£29.8.0** (Plus 7/6 carr. and ins.).

TERMS: Credit Deposit £7/7/- and 9 monthly payments of £2/14/-. H.P. Dep. £14/14/- and 12 monthly payments of £1/7/3.

BRIEF SPECIFICATION:—
A 9 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM Transmissions, plus the SHORT, MEDIUM and LONG waves. ● Has Push-Pull output, with negative feedback, for 6 watts Peak output. ● Quick action "Piano Jey" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 18in. × 9¼in × 8in. high. Dial size 11¼in. × 5¼in.

THE ARMSTRONG MODEL A.F. 105 AM/FM RADIOGRAM CHASSIS
A Genuinely Hand Made Chassis

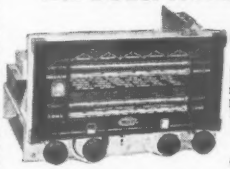


Developed to meet the needs of those who require really high quality radio and record reproduction but who, for reasons of expense or lack of room in existing or proposed cabinets, cannot consider the normal high-fidelity system. The A.F.105 is as good as, or better than many of the high quality amplifiers, and Associated units. Independent and continuously variable Bass and Treble controls give a wide range of control. **SEND S.A.E. FOR DETAILS.**

PRICE **£37** (Plus 7/6 carr. and ins.).

CREDIT SALE TERMS: Deposit £9/5/- and 9 monthly payments of £3/7/10.
HIRE PURCHASE TERMS: Deposit £18/10/- and 12 monthly payments of £1/14/4.

THE DULCI MODEL H.4



COMBINED AM/FM RADIOGRAM CHASSIS

A 4 Waveband Receiver designed for first-rate reproduction of Radio and Gram.

PRICE **£24.6.6** (Plus 7/6 carr. & ins.).

CREDIT TERMS: Deposit £6/2/- and 9 monthly payments of £2/4/7. **H.P. TERMS:** Deposit £12/3/3 and 12 monthly payments of £1/2/7.

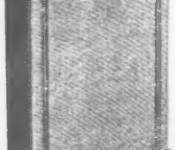
BRIEF SPECIFICATION:—
- Covers Short, Medium, Long and F.M. Wavebands.
- Employs full A.V.C.
- The latest 7-valve line-up.
- For 3 or 15 ohm P.M. Speakers.
- "Magic Eye" Tuning Indicator.
- Excellent Tone range up to 4 watts output
- Internal aerial for local stations.
- Overall size 15in. × 8¼in. × 7¼in. high.

A good Quality Chassis and Well Recommended.

HOME CONSTRUCTORS !!
BUILD YOUR OWN "Hi-Fi" LOUDSPEAKER SYSTEM

WITH W-B's WELL-KNOWN RANGE OF READY-TO-ASSEMBLE CABINETS. ALL ARE BEAUTIFULLY MADE AND FINISHED AND VERY EASILY ASSEMBLED. ONLY A SCREWDRIVER IS REQUIRED, THEY ARE PACKED FLAT IN CARTONS AND COMPLETE WITH SCREWS.
WE SHOW A FEW HERE BUT OTHERS ARE AVAILABLE. SEND S.A.E. FOR LEAFLET.

CALL IN AND LISTEN TO THEM.

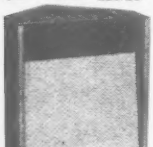


THE JUNIOR BASS REFLEX CORNER CONSOLE

A new contemporary-style cabinet, specially designed to give maximum reproduction quality from Stentorian 8in. or 10in. units with provision for Tweeter Unit, if required. Measures 33in. × 22½in. × 18¼in. Price **£9/9/-** or with the 8in. Stentorian Speaker **£13/12/6** or with 10in. Stentorian Speaker. **£14/8/6.**

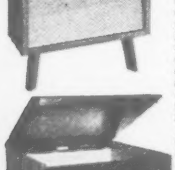
The "PRELUDE" Hi-Fi CONSOLE CABINET

Takes any make of tape-deck or record player amplifier pre-amplifier control unit, and radio tuner. Size 33in. × 19in. × 19¼in. Height above baseboard is 6¼in. Price **£13/13/-**



The "PRELUDE" BASS REFLEX CORNER CONSOLE

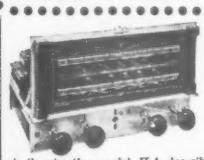
This most attractive cabinet has been specially designed to utilise the natural acoustic properties of the walls, and is also obviously suitable for use where space-saving is a consideration. It's sturdily constructed to take every advantage of Stentorian 8in. or 10in. units, with provision for Tweeter Unit. Size 33in. × 21in. × 17in. Price **£10/10/-** or with the 8in. Stentorian Speaker **£14/13/6** or with the 10in. Stentorian **£15/9/6.**



The "PRELUDE" Hi-Fi TABLE CABINET

Designed to take any make of Tape Deck or Single Record Player (not Auto-changers) Amplifier Pre-amplifier Control Unit, and Radio Tuner. Price **£9/19/6.** Size 19¼in. × 19in. × 19¼in.

HIRE PURCHASE and CREDIT SALES TERMS ARE AVAILABLE . . . SEND S.A.E. for details.
WE ALSO HAVE THE GOODMANS SHERWOOD ENCLOSURE IN STOCK.



THE DULCI MODEL H3.
COMBINED AM/FM RADIOGRAM CHASSIS

This model is very similar to the model H.4 described above but covers 3 WAVEBANDS instead of 4 (omitting the Short Band) and is for 3 ohm Speakers only. Overall size is as for the H.4.

PRICE **£20.17.0** (Plus 7/6 carr and ins.).

CREDIT TERMS: Deposit £5/4/3 and 9 monthly payments of £1/18/4. **H.P. TERMS:** Deposit £10/8/6 and 12 monthly payments of 19/4.

Stern's "fidelity" F.M. TUNING UNIT

A 5-Valve Tuner incorporating the latest Mullard Permeability Tuned Unit. Price assembled less Power Supply:

£14.10.0

(Plus 7/6 carr. and ins.).

TERMS: (a) H.P. Deposit £7/5/- and 9 monthly payments of 18/4.
(b) Credit Deposit £3/12/6 and 9 monthly payments of £1/6/7. Provides "Hi-Fi" reproduction with any make of Amplifier and many Radio Receivers. It incorporates:
● The latest Valve line-up—ECC85, 2 type EF86 EF91 and EM80. ● A "Magic Eye" Indicator. ● Power consumption is 1.7 amps. at 6.3 volts and 25 m/s at 250 volts.

STERN'S "fidelity" COMBINED A.M. and F.M. TUNING UNIT

This is IDENTICAL to the Stern's F.M. Tuner illustrated above, but in addition incorporates the MEDIUM WAVE-BAND and thereby also provides a selection of foreign stations. **PRICE £18.18.0** (Plus 7/6 carr. and ins.).

TERMS:—(a) H.P. Deposit £9/9/- and 10 monthly payments of £1/1/-; (b) Credit Deposit £4/15/- and 9 monthly payments of £1/14/7. **Send S.A.E. if further data required.**

HOME CONSTRUCTORS . . . You can build

(a) The "fidelity" F.M. TUNING UNIT FOR **£10.0.0**

(b) The "fidelity" AM/FM TUNING UNIT for **£13.10.0**

The COMPLETE ASSEMBLY DIAGRAMS and INSTRUCTIONS CAN BE OBTAINED FOR 1/6 each.

!! SPECIAL CASH OFFERS !!

The Latest Collaro 4 Speed Single Record Player
Incorporating the very popular STUDIO "C" CRYSTAL PICK-UP
For only **£6.19.6**
(Plus 5/- carr. and ins.).
Incorporates Auto-Stop and Plays 78 r.p.m. and all types of L.P. Records.

The Collaro "Junior" Rim Drive 4 Speed Record Player
Offered complete with Collaro Crystal Pick-up For **£4/10/0.**
(Plus 4/- carr. and ins.)
We also offer . . . Gram Motor and Turntable at £3/2/6. Crystal Pick-up only. £1/12/6. (Carr. and Ins. 2/6 extra).

"FRUSTRATED EXPORT ORDER"

The Cossor Model 527/X4 Valve "All-dry" Battery Portable.
Offered For **£6.15.0**
Plus 5/- carr. & ins

Consists of a 4 valve Superhet Receiver covering Medium Waveband 197-575 metres, and two Short Wavebands 13.6 to 136 metres. The new low consumption valves are incorporated and the whole is accommodated in an attractive robustly made case. Battery required is 90 volts and 1.4 volts (price 19/6) and is external to case.

RECORD PLAYERS
THE VERY LATEST MODELS ARE IN STOCK
MANY AT REDUCED PRICES ! ! ! !
TRANSCRIPTION UNITS—AUTOCHANGERS SINGLE RECORD PLAYERS
Send S.A.E. for ILLUSTRATED STOCK LIST

CASH ONLY OFFER ! ! !

This latest Brand New B.S.R. MONARCH 4-SPEED AUTOCHANGER
£7.19.6 (Plus 5/- carr. and ins.).
● Minimum baseboard size required 16in. × 12½in. with height above 5¼in. & height below baseboard 2¾in.

WE ALSO HAVE A FEW ONLY

COLLARO 4-Speed "Mixer" Autochangers. The Units are BRAND NEW and incorporate the STUDIO "C" Pick-up. PRICE **£8.15.0** (Plus 5/- carr. and ins.)

Open Monday to Friday 9 a.m.—6 p.m.
Saturday 9 a.m.—1 p.m.

STERN RADIO LTD.

THE 1958 NEW LOOK MULLARD DESIGNS FOR THE HOME CONSTRUCTOR AMPLIFIERS PRE-AMPLIFIERS

COMPLETE KITS OF PARTS FOR THE "HI-FI" ENTHUSIAST
Designed by MULLARD—Presented by US strictly to their specification.

THE VERY POPULAR MULLARD "5-10" MAIN AMPLIFIER

Undoubtedly the most successful amplifier yet designed, and used in conjunction with the new Mullard Pre-Amplifier, an undistorted power output of up to 10 watts is obtained. Thoroughly recommended to the "Hi-Fi" enthusiast who contemplates a very high quality home installation. In addition the versatility of the equipment makes it quite suitable for use in small halls, etc. We supply complete to MULLARD'S SPECIFICATION with specified valves and components and including the latest PARMEKO Ultra linear Output transformer. Has power available to drive Radio Tuning Unit.

Price for COMPLETE KIT OF PARTS..... **£10.0.0**
Alternatively we supply ASSEMBLED and TESTED **£11.10.0**
(Carriage and insurance 5/- extra.)

We also offer this "5-10" incorporating the latest PARTRIDGE ULTRA-LINEAR OUTPUT TRANSFORMER for £1/6/-. extra.

MULLARD'S NEW 2-STAGE PRE-AMPLIFIER-TONE CONTROL UNIT

A completely new design employing two EF86 valves, and in particular designed to correctly operate with the Mullard range of Power Amplifiers.

Briefly it incorporates:—

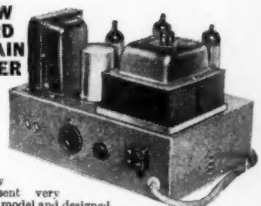
- Equalisation for the latest R.I.A.A. characteristics.
- Input for variable reluctance. Magnetic Pick-ups
- Input for Crystal Pick-ups.
- Input for Tape replay.
  - (a) Direct from High Impedance Tape Head.
  - (b) From a Tape Amplifier or Pre-Amplifier.
- Sensitive Microphone Channel.
- Wide range BASS and TREBLE Controls.
- Attractive Perspex front control panel.
- Our Kit is strictly to MULLARD'S SPECIFICATION.

Price, COMPLETE KIT OF PARTS **£6.6.6**
Alternatively we supply ASSEMBLED and TESTED **£8.8.0**
(Carriage and Insurance 5/- extra.)

NOTE WE DO *NOT* USE SURPLUS OR CHEAP COMPONENTS IN ANY OF OUR MULLARD KITS or ASSEMBLED UNITS.

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required ... alternatively the COMPLETE ASSEMBLY MANUALS containing component Price Lists and practical Drawings etc. are available at 1/6 each.

THE NEW MULLARD "3-3" MAIN AMPLIFIER



Based entirely on the present very popular "3-3" model and designed to operate in conjunction with the new 2-stage PRE-AMPLIFIER (shown here) this providing all the facilities associated with the more expensive "Hi-Fi" equipment. We recommend it as the IDEAL SMALL HOME INSTALLATION where very high quality is desired at the lower volume level (up to 3 watts).

We supply completely to MULLARD'S SPECIFICATION INCLUDING the latest PARMEKO Output Transformer, specified Valves and Components. Has Power available to drive a Radio Tuning Unit.

Price for COMPLETE KIT of PARTS **£7.0.0**
Alternatively we supply ASSEMBLED and TESTED..... **£8.0.0**
(Carriage and Insurance 5/- extra.)

SPECIAL PRICE REDUCTIONS—WE OFFER

HIGH QUALITY OF THIS NATURE HAS NEVER BEFORE BEEN OFFERED AT SUCH LOW COST

(a) THE COMPLETE KIT of PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-stage PRE-AMPLIFIER-CONTROL UNIT **£12.10.0**

(b) THE COMPLETE KIT of PARTS to build both the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**

*ALL PRICES QUOTED FOR THE "5-10" ARE SUBJECT TO £1/6/- EXTRA IF THE PARTRIDGE TRANSF. IS REQUIRED.

(a) THE "3-3" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED..... **£15.0.0**

CREDIT TERMS: DEPOSIT £3/15/- and 9 monthly payments of £1/7/6.
H.P. TERMS: DEP. £7/10/- & 9 monthly payments of 19/-.

(b) THE "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED..... **£18.18.0**

CREDIT TERMS: DEPOSIT £4/15/- and 9 monthly payments of £1/14/7.
H.P. TERMS: DEP. £9/9/- & 12 monthly payments of 17/6.

When ordering please include an extra 7/6 to cover cost of carriage and insurance.

THE NEW COMPLETE MULLARD "5-10" AMPLIFIER

ANOTHER NEW DESIGN ILLUSTRATION NOT AVAILABLE AT TIME OF GOING TO PRESS AMPLIFIERS AVAILABLE EARLY APRIL

This Amplifier is similar to the "5-10" illustrated above, but it has ALL CONTROLS incorporated on the Amplifier Chassis in the same way as the "3-3" (illustrated alongside) finished with our attractive PERSPEX FRONT PANEL, thus forming a complete Amplifier.

We supply it complete to the MULLARD SPECIFICATION including specified Valves and components and incorporating the latest PARMEKO ULTRA LINEAR OUTPUT TRANSFORMER and switched inputs for 78 and L.P. Records plus a Radio Tuning Unit. Extra Power is available to drive the Tuning Unit.

Separate BASS and TREBLE CONTROLS provide excellent range of tone and we recommend the Amplifier to those with limited Cabinet space who require GENUINE HIGH QUALITY at a higher volume level than the "3-3" but without the versatility of the separate Preamplifier-Control Unit with Main Amplifier.

Price COMPLETE KIT of PARTS **£11.0.0**
Alternatively we supply ASSEMBLED and TESTED **£13.10.0**
Credit Sale: Dep. £3/7/6 & 9 monthly payments of £1/4/11.
H.P. Terms: Dep. £8/15/- & 8 monthly payments of 19/3.

Send S.A.E. for ILLUSTRATED LEAFLET or alternatively the COMPLETE ASSEMBLY MANUAL IS AVAILABLE FOR 1/6.

STERN'S "ndelity" PRE-AMPLIFIER-TONE CONTROL UNIT

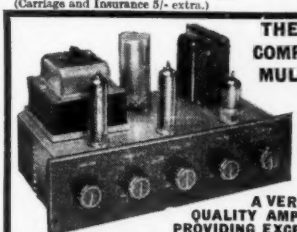
A versatile 2-State Unit using two ECC 83 Valves and incorporating a Preset Output Control, the function of this Control is to provide for variation of output, thus enabling the Unit to be used with any Amplifier where correct matchings and a good tone range is desired.

Briefly it incorporates: (a) Inputs for all types of MICROPHONES, HIGH or LOW GAIN PICK UPS and RADIO TUNING UNIT (b) STEEP CUT FILTER (c) GRAM EQUALISER (d) Separate BASS and TREBLE CONTROLS (e) Input for TAPE REPLAY (f) Attractive PERSPEX FRONT CONTROL PANEL. The outstanding features of this unit are correct equalising for Gram reproduction, excellent control of Bass and Treble, extreme simplicity of operation.

Price COMPLETE KIT OF PARTS **£6.16.0**
Alternatively we supply ASSEMBLED and TESTED **£8.10.0**
(Carriage and Insurance is 5/- extra.)

The ASSEMBLY MANUAL, containing Specification and Drawings, etc., is available for 1/6 or send S.A.E. for illustrated leaflet if required.

THE NEW COMPLETE MULLARD "3-3"



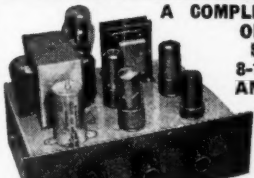
A VERY HIGH QUALITY AMPLIFIER PROVIDING EXCELLENT REPRODUCTION AND HAVING AN ATTRACTIVE ENGRAVED PERSPEX FRONT PANEL.

Price for COMPLETE KIT OF PARTS **£7.10.0**
(plus 6/6 carriage and insurance).
Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**
(plus 6/6 carriage and insurance.)

The complete specification is available for 1/6.

Developed from the very popular 3-valve 3-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to the Mullard specification, including supply of specified components, valves and a PARMEKO OUTPUT TRANSFORMER. We also include switched inputs for 78 and L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available.

A COMPLETE KIT OF PARTS, STERN'S 8-10 WATT AMPLIFIER



Has power supply available for Radio Tuning Unit.

Price of COMPLETE KIT OF PARTS (plus 5/- carr. & ins.) **£7.10.0**

WE ALSO OFFER IT ASSEMBLED and READY FOR USE for (plus 5/- carr. & ins.) **£9.10.0**

This amplifier has proved one of the most popular models yet offered to the HOME CONSTRUCTOR. It provides really excellent reproduction up to 8 watts, employing 6V6's in push-pull and incorporating negative feedback. Provides for the use of both 3 and 15 ohm Speakers. The complete SPECIFICATIONS and BUILDING INSTRUCTIONS ARE AVAILABLE for 1/6.

SPECIAL CASH ONLY OFFER ! !

This very attractive PORTABLE AMPLIFIER CASE together with a good quality GRAM AMPLIFIER and a matched P.M. SPEAKER, ALL FOR ONLY **£8.7.6**

(plus 7/6 carr. & ins.). The Amplifier consists of a 2 stage design incorporating the 3 modern BVA valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Grey colour Rexine—WE ALSO SUPPLY SEPARATELY:—

(a) The 2-Stage (plus Rectifier) AMPLIFIER £4/2/6
(b) The PORTABLE CARRYING CASE..... £3/17/6
(c) 6½in. P.M. SPEAKER 18/9
(Carriage and insurance 4/- extra.)

We also have a smaller PORTABLE CASE ideal for Record Players. PRICE ONLY £3/3/- (plus 3/- carr. & ins.). Attractively finished in high-grade Rexine and robustly constructed with internal measurements at 13½ x 15½in. high. It will therefore accommodate all makes of Record Players including Autochangers. An uncut baseboard is also supplied.

"HI-FI" AMPLIFIERS IN STOCK

include STERNS COMPACT "5-2". DULCI D.P.A.10 DULCI H.11. ARMSTRONG A10 Mk11. "Variolope" LEAK "VARISLOPE" PRE-AMPLIFIER. ROGERS "JUNIOR" R.C.A. ORTHOPHONIC. *Send S.A.E. for details.*

F.M. TUNING UNITS BY MOST OF THE LEADING MANUFACTURERS.

STERN'S POWER SUPPLY UNIT

Fully smoothed with all output connections terminated to connecting Blocks. Overall size is 9½in. x 3½in. x 4½in. high. TWO MODELS AVAILABLE, Type "A" provides 250-300 volts up to 70 m/a. and 6.3 volts at 3½ amps. PRICE **£2.17.6**

Type "B" Unit 250-300 volts at up to 100 m/a. and 6.3 volts at 3½ amps. PRICE **£3.3.0.**

(Plus 2/- carr. and ins.).

Please enclose S.A.E. with all enquiries

109-115 FLEET ST. LONDON E.C.4

Phone: FLEet Street 5812-3-4

Are you up to date?

British Plastics Year Book records annually the changes in the plastics industry. Over 8000 revisions in ONE YEAR

Up-to-the-minute classified guide to the plastics industry

British Plastics Year Book 1958

Whether you buy or sell plastics, make or use the industry's machinery or equipment, the revised and completely up-to-date 1958 edition will prove invaluable to your work. Here, carefully arranged and indexed, is all the general and technical information you need to answer the daily problems concerning the plastics industry.

Includes materials, products, plant and equipment; names and addresses, details of new companies, the year's patents—and a wealth of other essential data.

Make sure you have ready access to this authoritative reference book. Get your copy NOW.

816 pp . . . 8 sections . . . nearly 30,000 entries

from leading booksellers 42s net by post 43s 9d

Published for "British Plastics" by

ILIFFE & SONS LTD. DORSET HOUSE STAMFORD STREET LONDON SE1

- **RADIO and TV ENGINEERING**
- **RADIO and TV SERVICING**
- **ENGINEERING MATHEMATICS**
- **PRODUCTION ENGINEERING**
- **ELECTRONICS · MANAGEMENT**

▶ **Examination Courses for:** Brit. I.R.E., C. & G. Telecommunications, R.T.E.B. Certificate Society of Engineers, Brit. Inst. of Management.

▶ **PRACTICAL RADIO COURSE.**
A course in radio, electronic and electrical theory. You build a T.R.F. and a 5-valve superhet radio receiver, signal generator and multi-tester.
You learn at home in your own time, under expert tuition. Moderate fees include all books.

POST THIS COUPON TODAY for FREE book on careers in Radio, etc., and full details of I.C.S Courses.

Start today the **I.C.S. way!**

INTERNATIONAL CORRESPONDENCE SCHOOLS
Dept. 223L, International Buildings, Kingsway, London, W.C.2.

Name..... Age.....
(Block letters, please)
Address.....
.....
Occupation 4.58

INTERNATIONAL CORRESPONDENCE SCHOOLS

MIDLAND INSTRUMENT CO.

MONOCULARS. Infra-red Tabby equipment, consists of the optical system, variable eyepiece and objective, interposed between is the image convertor cell and Wratten filter, adjacent is the self-generating 1,500-v. Zamboni dry pile with H.T. press switch, all complete and self-contained in metal case size 8i... x 5in. x 2½in., weight 3lb., fitted adjustable leather shoulder strap, purpose for direct viewing of infra-red sources in complete darkness, these are new, unused price, believe it or not, is **7/6**, post 2/6 2 for **15/-**, post 3/-.

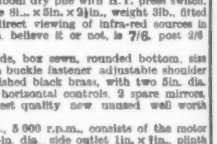
LEATHER CASES. Very superior ¼in. thick hide, box sewn, rounded bottom, size 7½ x 4in. by 10in. deep, hinged overlap cover with buckle fastener adjustable shoulder strap, contains a heliograph set, all optically finished black brass, with two 5in. dia. mirrors swivel mounted, one with vertical and horizontal controls, 2 spare mirrors, adjustable arm, bracket and tools, all of the finest quality new unused well worth £10, our price **10/-**, post 3/-.

MAINS BLOWER. 200/250 v. A.C./D.C., ½ amp., 5 000 r.p.m., consists of the motor with attached enclosed fan, and funnel intake 1½in. dia. side outlet 1in. x ¾in., plinth base 5in. x 4½in., finish black crackle and diecast aluminium, size overall 9in. long, 4½in. wide, 5in. high weight 7½lb., a very superior blower, offered at a fraction of original cost, new unused **25/-**, post 3/6.

BALANCED ARMATURE RECEIVER INSERTS No. 5, in black plastic cases, the most popular and versatile of all ex-Govt. stock. Ideal as single or dual headphone receivers, self-energised microphones, 2 coupled by ordinary twin flex, provide an efficient 2-way telephone system, brand new perfect stock in sealed cartons, **3/9** each, post 1/-, 3 for **10/6**, post 1/6, **40/-** doz., post 3/-, sealed wood cases containing 54 receivers, **28/2/-** carriage 100-m. **7/6**. 200-m. **10/-**, 300-m. **12/6**. C.I., N.I. and I.O.M. **20/-**.

ELECTRIC PUMPS, suitable for most liquids, the popular cylindric immersible type, 24-v. at which they deliver 10-g.p.m. at 20ft. head, also give excellent performance at 12-v., new in sealed cartons, lft. long **30/-**, post 2/3; ditto 4ft. long **35/-** carriage 5/-.

HUGHES MOTOR, shunt wound, 12-v. 1½-amp. speed 5 000 r.p.m., reversing, size 3½in. long 1¼in. dia., ¼in. shaft, weight 20 oz., a very superior motor designed for anti-radar equipment new unused **10/-**, post 1/6, **25** per doz., carriage paid, ditto fitted reduction gear giving a final drive (¼in. shaft) of either 320 or 160 r.p.m., state which required, **12/6**, post 1/9; **26** per doz., carriage paid.



POWER SUPPLY UNITS No. 5, consists of the hand generator, which charges 6-v battery at 5 amps., or a 12-v. at 3 amps., complete with cut-out, vibrator pack, 6-v input provides all H.T. and L.T. supplies for the 18 and 38 sets spare Mallory-type 650 vibrator, connecting leads, bakelite battery box, contained in metal back carrying pack, size 17in. x 10in. x 7½in., new in sealed cartons, 35/-, carriage 100-m. **7/6**. 200-m. **10/-**, 300-m. **12/6**. C.I., N.I. and I.O.M. **20/-**.

LOUDSPEAKERS by Pye, Philips, etc., consists of the 10in. dia. P.M. speaker, 3 ohm coil, less transformer, fitted in a smart brown finished wood case, size 17 x 17 x 6½in. with carrying handle, metal grill at front with 4 smaller ones at rear, rear compartment contains 50ft. superior twin lead fitted standard jackplug, new in sealed cartons, special bargain offer **37/6**, car. 100-m. **6/-**, 200-m. **8/6**, 300-m. **11/-**, C.I., N.I. and I.O.M. **15/-**.

SELENIUM RECTIFIERS. These are latest brand new G.E.C. supply, not ex-Govt. or assembled from bits, full-wave bridge, 12-v. 1½ amp. cont., 2 amp. int., **10/-** post 1/-; ditto, 12-v. 3 amp. cont., 4 amp. int., **15/-**, post 1/6; mains transformers to suit 200/230/250-v., with 5-11-17-v. outputs to charge a 2, 6 or 12-v. battery, brand new, 1½ amp. type, **15/-**, post 1/9; 3 amp. type, **20/-**, post 2/3, complete with wiring diagram.

MERCURY SWITCHES, 250-v. 10-amp. glass tilt type fitted brackets, specially designed to give 3-second delay make after tilt, new, boxed, **5/-**, post 1/- **50/-** doz. post paid.

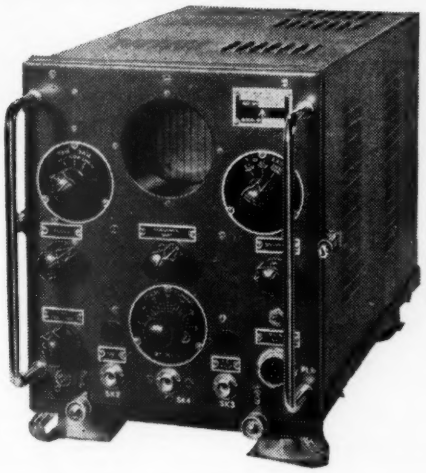
MAGNETIC RELAYS, 12-v. ½ amp. operation, closes 40 amp. D.C. contacts, in bakelite cases with cover, new unused, **2/6**, post 10d., **24/-** doz., 3/-.

Many other Bargains; send stamped addressed envelope for lists.

MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17
Tel.: HAR 1308

OSCILLOSCOPE

The Ministry of Supply Monitor Type 61 is a First-Grade Synchroscope designed for D.C. Pulse and R.F. Envelope investigation, and employs a 3½in. CRT type VCR138A. The R.F. Frequency is 180/220 Mc/s approx.; and is tuneable in that range. Has internal 500 kc/s. Calibrating Oscillator on Y Plates. Existing Time Base Speeds are 50 cycles, 20 Micro-seconds fast, and 1,000 Micro-seconds slow. Conservatively rated Mains Power Pack is for nominal 115 v. and 230 v. Will make up into an excellent General-Purpose Oscilloscope at a cost of a few shillings, full modification data being supplied. Front panel size is 10½in.x12½in., depth of unit being 19in. **BRAND NEW AND UNUSED. ONLY £12/10/-** (carriage, etc., 15/-).



COMMUNICATIONS RECEIVER R.107

Just purchased from the Ministry of Supply, this magnificent 9 valve 3 Wave-band receiver gives world wide reception over a coverage of 1.2–17.0 Mc/s. (18–250 metres), taking in several important Amateur Bands, Shipping Band and part of the Medium waveband, including the B.B.C. Light Programme. The sensitivity is 1 micro-volt on C.W. and 2–6 micro-volts on R.T. The controls include a Bandwidth Switch (" Wide " or " Narrow "), choice of AVC and BFO, Audio Filter, RF Gain, Aerial Trimmer. Has built-in Output Stage with Internal Speaker, which can be switched out to use Headphones. Uses normal International Octal Valves. Incorporates A.C. Mains Power Unit for 100–250 volts and Vibrator Pack for 12 volts D.C. In grey metal case size 24×13×17in. These sets are used, but in first-class condition, thoroughly checked and aerial tested before despatch. Complete, ready to switch on. ONLY **£8/19/6** (carriage 20/- England and Wales, rest of U.K. extra). S.A.E. for leaflet.

MARCONI SIGNAL GENERATOR TF-517-F/1. Special offer of these Laboratory Signal Generators. Cover 10–18 Mc/s., 33-58 Mc/s. and 150–300 Mc/s. In good, used condition, with charts. Checked before despatch. Complete with power pack for normal A.C. mains. ONLY **£12/10/-** (carriage, etc., 20/-).

MARCONI SIGNAL GENERATOR TF144G. Frequency coverage 85 kc/s. to 25 Mc/s., and known as a Laboratory Standard. For normal A.C. mains and complete with all leads. Reconditioned AS NEW. ONLY **£65.**

R1155 SUPER SLOW-MOTION TUNING ASSEMBLY. As used on all late model 1155's. Easily fitted to " A " sets, etc. ONLY **12/6.**

ROLA 6½in. P.M. SPEAKER. Mounted in grey crackled metal cabinet. 9×9×4½in. and with volume control. BRAND NEW AND UNUSED. ONLY **27/6.**

EHT TRANSFORMERS. 5.5. kV. (Rect.) with 2 v. 1 a., **79/6.** 7 kV. (Rect.) with 2 v. 1 a., **89/6.** 2.5 kV. (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR 97 tube, etc.), **42/6** (postage 2/- per trans.).

500 MICROAMPS METER. 2in. circular as used on British No. 19 Wireless Sets. Calibrated 0–15 and 0–600 volts, resistance 500 ohms. A very fine instrument and A SNIP AT ONLY **15/-.**

TCS TRANSMITTERS

The renowned American TCS Model designed by the Collins Company for static or mobile use. Covers 1.5–12.0 Mc/s. in 3 bands and is complete with 7 valves, employing 2 of 1625 in P.A. Stage, 1 each of 1625 in Buffer and Modulator Stages, and 3 of 12A6 in Oscillator Stage. Provision for VFO or Crystal Control. 4 Cyrstal positions. Radio Telephone or Radio Telegraph. Has Plate and Aerial Current Meters. Power requirements 12 v. L.T. and 400 v. H.T. In black crackle case, size 11×13×11in., condition BRAND NEW and UNUSED. ONLY **£12/10/-** (carriage, etc., 15/-).
The double Dynamotor Power Unit, Type 21881B for 12-volt operation, delivering 400 v. for Transmitter and 225 v. for Receiver, is available at **£12/10/-** (carriage, etc., 15/-).

FREQUENCY METERS TYPE L.M.

The United States Navy version of the BC221. Frequency range 125–20,000 kc/s. with better than 0.01% accuracy. Contains a Crystal Controlled Oscillator, a Heterodyne Oscillator and an Audio Frequency Amplifier. Can be used as Signal Generator, having CW-MCW control. BRAND NEW and UNUSED. Quotations on request.

MARCONI BAND III CRYSTAL CALIBRATORS. Frequency range 170–240 Mc/s. Incorporates 5 Mc/s. crystal for better than .001 per cent. accuracy. Directly calibrated dial, internal A.C. mains pack. Complete with spare set of valves and instruction manual in maker's transit cases. BRAND NEW. ONLY **£4/19/6.**

12-WAY SCREENED CABLE. In 10ft. lengths, fitted with plugs, originally made for use with the 19 Set. UNUSED. ONLY **17/6** per lead.

POCKET VOLTMETERS. Not ex-Govt. Read 0–15 v. and 0–300 v. A.C. or D.C. BRAND NEW AND UNUSED. ONLY **18/6.**

CRYSTALS. British Standard 2-pin 500 kc/s., **15/-.** Miniature 200 kc/s. and 465 kc/s. **10/-** each.

SPECIAL MAINS TRANSFORMER OFFER. Normal 230 v. A.C. Primary. Secondaries 330–0–330 v. 100 mA. 4 v. 3 amps. Ex-W.D. BRAND NEW AND UNUSED. ONLY **15/-** (postage, etc., 2/6).

CHOKES. 10H 60 mA. **4/-.** 5H 200 mA. **7/6.**

FILAMENT TRANSFORMERS. 6.3 v. 1½ amps. **7/6.** 6.3 v. 3 amps. **10/6.**

6 v. VIBRATOR PACKS. Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. ONLY **12/6.**

Cash with order please, and print name and address clearly

PLEASE ADD POSTAGE OR CARRIAGE COSTS ON **ALL** ITEMS

HARRIS ELECTRONICS (LONDON) LTD.

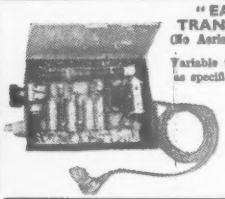
Radio Corner, 138 Gray's Inn Road, London, W.C.1 *Phone:* TERMINUS 7937

Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross

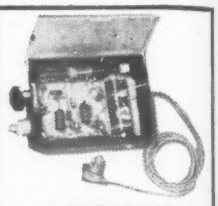
Henry's

RADIO COMPONENTS
ELECTRONIC & TELEPHONE EQUIPMENT

5, HARROW ROAD, PADDINGTON, W.2.
PADDINGTON 1008/9
OPEN MONDAY-SATURDAY 9-6, THURSDAY 9-1

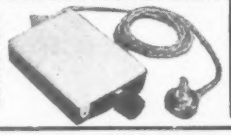


"EAVESDROPPER" THREE TRANSISTOR POCKET RADIO
(No Aerial or Earth required in areas of good signal strength)
Variable tuning on medium waves. Total cost as specified, including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case. All items sold separately. Full practical layout diagrams ..... 77/6 post free. With balanced armature earpiece 81/-. With Acos Mike, 90/-. With Min. Hearing Aid, 90/-.



"HOMELIGHT" TWO TRANSISTOR PERSONAL PORTABLE
Variable tuning. We can supply all components, including two Transistors, Diode, Resistors, Condensers and Miniature Hearing Aid and plastic case, size 4½ × 2½ × 1¼in., and 1½-volt battery for 52/6. Practical layout. All items sold separately.

MINI-TWO TWO TRANSISTOR MINIATURE POCKET RADIO
The smallest Transistor set offered on the market. Variable tuning. Drilled chassis, plastic case 3 × 2 × ⅞in., Miniature Hearing Aid, 2 Transistors and all components including 1½ volt battery, circuits and full practical layout diagrams. All components sold separately. Total cost 49/6 complete.



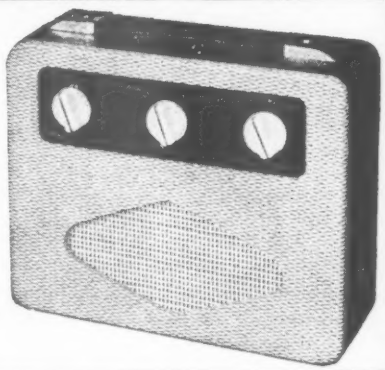
"TRANSISTOR—8"
Push-Pull Portable Superhet

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Simplified construction enables this set to be built easily and quickly into an attractive lightweight cabinet supplied.

TEN STAR FEATURES
★ 8 Specially selected Transistors
★ 250 Milliwatts Output Push Pull
★ Medium and Long Waves
★ Internal Ferrite Rod Aerial
★ 7 × 4 Elliptical Speaker
★ Drilled Plastic Chassis of 8½ × 2½in.
★ Point to Point wiring and practical layout
★ Economical. Powered by 7½ v. battery
★ Highly sensitive
★ Attractive lightweight contemporary case

CAN BE BUILT FOR £11/10/-.
N.B.—Pair of XC101's supplied at additional cost of 40/-. Call and hear demonstration model.

We can supply all these items including Cabinet for £11/10/-. All parts sold separately. Send for circuit diagrams, assembly data, illustrations and instructions. Full shopping list FREE.

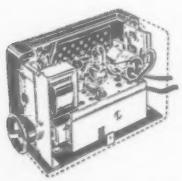


TRANSISTORS
JUNCTION TYPE P-N-P. (British Manufacture.)
RED-SPOT 800 Kc/s Audio Frequency 10/-
BLUE-SPOT 1.6 Mc/s Mixer and Frequency Changer 15/-
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp. 20/-
All Transistors are Tested and Guaranteed
NB.—The Red-Spot is similar to Mullard OC71.

STOP PRESS
Transistor 8 now available as car radios, full details available on request.

13 Channel Converter

for I.T.A.—£5.5.0 (p. & p. 3/-)



Illust. with half of moulded case removed. 3-position switch giving Off-I.T.A.-B.B.C. Valves PCF80 and PCC84. In moulded case 8½ x 4½ x 6in. High gain, low noise.

CO-AXIAL cable, low loss, 8d. yd.
AERIALS, Band 3, 5-element, 35/-; 9-element, 55/-; for fixing to existing mast, 1in. to 2in. dia. (carr. pd.).
AUTO-CHANGERS, Collaro RC457, 4-speed, mixer, 200v.-250v. A.C. Turnover crystal head, £8/16/6 plus 5/- carr. **SINGLE PLAYER** Collaro AC3/554, 3-speed, turnover crystal pick-up. £6/16/6 (3/6 carr.).
BATTERY ELIMINATOR for 4 low consumption valves, 90v. 15 m/a. and 1.4v. 125 m/a., 35/- (p. & p. 2/6).
I.T.A. TURRET TUNERS, Brayhead and Cyldon, £7/7/- (state B.B.C. and I.T.A. and make and model number of T.V.).

ALL NEW GOODS. 12 months' guarantee on converters.
3 months' on valves. Terms available.

Gladstone Radio

82B High St., Camberley, Surrey.
3 Church Rd., Redfield, Bristol 5.

SAMSON'S SURPLUS STORES LTD.

NEVLIN 3,000-WATT AUTO TRANSFORMERS. Input 200-250 v. Output 110 v. Completely enclosed in grey metal cases. With input voltage selector switch and fuses. Supplied brand new at a fraction of maker's price. £9/15/- plus carr. 7/6.

HEAVY DUTY L.T. TRANSFORMERS. Pri. 220-230 v. Sec. 50 v. 30 amp. £6/10/- carr. 10/-. Pri. 200-250 v. Sec. tapped 28, 29, 30, 31 volts 21 amps. £4/10/- carr. 7/6. Pri. 200-240 v. Sec. 45 v. 1 amp. Completely enclosed in metal container. 25/-. P.P. 2/6. Pri. 180-230 v. Sec. 4.2 v.+4.2 v. Conservatively rated at 10 amps. 19/6 carr. 3/6. Pri. 200-240 v. Sec. 6.3 v. 15 amp. 25/-. P.P. 2/6.

METAL RECTIFIERS. 6-12 v. 10 amp. 45/-. P.P. 3/-. 6-12 v. 6 amp. 27/6. P.P. 2/-. 24 v. 2 amp. 17/6. P.P. 2/-. 72 v. 1½ amp. 32/6. P.P. 2/-.

WILLARD 24 v. 11 A.H. AIRCRAFT BATTERIES. Completely enclosed in metal container. Size 8 × 7½ × 7¾in. Supplied new in maker's carton with charging instructions. 62/6 carr. 5/-. Admiralty 24 v. 3 A.H. batteries comprising twelve 2 v. glass cells in wooden crate. Size 12 × 6½ × 4½in. 45/-. Carr. 6/-.

250 MICROAMMETERS. 2½in. panel mounting. Scaled in ohms. 35/-. P.P. 1/6.

ADMIRALTY INTEGRATORS TYPE AS91. Incorporating a very fine galvo. movement. Coil 40 ohms. Centre zero to F.S.D. 1 microamp. Small mirror, 1 metre radius. A very useful laboratory instrument. 65/-. Carr. 5/-.

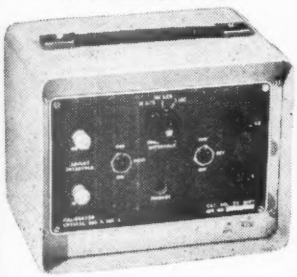
HIGH-GRADE SLEEVING. 1½-5 mil. Mixed bundle. Wonderful value. 2/6. P.P. 1/-.

169-171 EDGWARE ROAD, LONDON, W.2

Tele. PAD. 7851 and AMB. 5125

CRYSTAL CALIBRATOR

No. 7 Mark 2.
10 kc/s—100 kc/s—1 Mc/s.



Battery operated input 60 v. and 2 volt. Complete with 6 valves, 5-1T4 and 1R5 and Xtal. and 'phones. This instrument is a modern version housed in small metal case. Brand New in transit case.

£5/19/6

AC/DC 200/250 PORTABLE-GRAM AMPLIFIER.

Completely assembled on Baffle Board size 12½ x 4½in. Depth 3 in. Containing two Mullard Valves types UL84 and UY85, Elac 7 x 4 Elliptical Speaker, Volume Control, Tone Control. Nothing else to buy, just plug in to Mains and connect your Pick-up to Amplifier.

67/6
Carr. 2/6.
Absolute Bargain.

U.S.A. TESTMETER TYPE "834-S"

A.C./D.C. 15 RANGES

Complete in wooden carrying case with leads and internal batteries.

A.C./D.C. Volts 12/60/300/600 v. /1,200/6,000 v.
Milliamps 1.2/12/60/600 m/a.
Ohms 0-5000/5 meg F.S.D. 1,000 o.p.v.

£6/19/6

WAVE-GUIDE WATTMETER

Type W892! 10 cm. Complete in transit case.
BRAND NEW **£5/10/-**

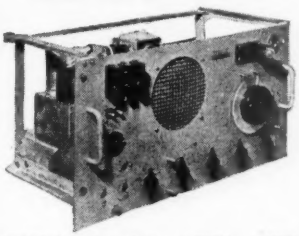
TEST SET 229

Admiralty type 600 Mc/s. Complete in transit case.
BRAND NEW **£5/10/-**

RT10/APS-3
3 Centimeter Radar Unit

Containing 725A Magnetron, 2—723A/B's, 2—6AC7's, 724A, IN23, magnet and pulse trans.
BRAND NEW IN CARTON **£10/10/-**

Sputnik Special
SHORT-WAVE COMMUNICATION RECEIVER
10-60 Mc/s (5-30 Metres)
RECEPTION SET TYPE 208



Containing 6 valves, 2-6K8G, 2-EF39, 6Q7G and 6V6G, Metal rectifiers, built-in mains pack and 6 v. Vibrator pack, built-in 6½in. speaker. Muirhead slow motion drive, B.F.O. and R.F. stage. 2 Mc/s I.F. freq. Provision for 'phones and muting and 600 ohm line.

Input 100/250 v. A.C. 50 Cycles

£6/19/6
Carr. 15/6.

In new condition and air tested.
Complete in metal transit case

BE PREPARED TO LISTEN TO THE SATELLITES

TRIPLETT A.C./D.C. POCKET TEST-METER TYPE 666H

15 ranges 1,000 ohm per volt.

In new condition with Prods and Internal battery.

A.C./D.C. 10/50/250/1,000/5,000 volts.
Milliamps 0-10/100/500.
Ohms 0-300/250,000.

£5/10/-

CATHODE RAY TUBES

VCR138A with screen	£1	15	0
VCR139A	£1	15	0
VCR139A Mu-metal Screen		5	6
VCR97. Full T.V. picture (carr. 2/-)	£2	0	0
VCR517C. Full T.V. picture	£1	15	0
MU-METAL SCREENS for VCR97 or 517		10	0
VCR97. Slight cut-off. Carr. 2/-...		15	0
3PB1. Brand new.....	£1	10	0

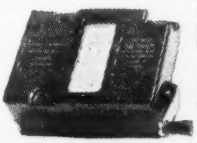
PIRANI HIGH-VACUUM TEST EQUIPMENT
with calibrator and galvo.

£33/10/-

SEND FOR BOOKLET

EVERSHED 500 VOLT WEE-MEGGERS

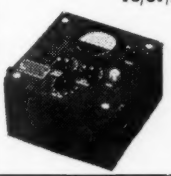
Brand New 0-50 meg. with leather case and books in original packing. **£12/10/-**



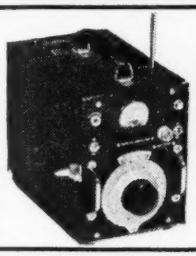
Used in new condition with leather case, **£8/19/6**

100 volt type with leather case. **£6/0/0**

U.S.A. R.F. WATTMETER TS/87/AP



Three position 0-10/15/30 w. Complete with photo-cell, 2 spare lamps and leads, with transit case.
BRAND NEW **£10/10/-**



BC 906D FREQUENCY METER

Range 150-235 Mc/s. New condition. **45/-**

"373" MINIATURE IF STRIP 9.72 Mc/s

The ideal F.M. conversion unit as described in 'P.W.' April/May, 1957. Complete with 6 valves, three EF91's, two EF92's and one EB91, I.F.T.'s etc., in absolutely new condition. With circuit and conversion data. **42/6**

12/6 (less valves) (with valves).
Postage and packing 2/6 (either type).

WALKIE/TALKIE TYPE 38 TRANSMITTER/RECEIVER

Complete with 5 valves. In new condition, With circuit. These sets are sold without guarantee, but are serviceable. **22/6**
P.P. 2/6.

H/phones 7/6 pair. Junction box 2/6. Throat mike 4/6. Canvas bag 4/-. Aerial Rod 2/6.

TRANSMITTER/RECEIVER ARMY TYPE 17 MK. II

Complete with Valves, High Resistance Headphones, Handmike and Instruction Book and Circuit.

Frequency Range: 44.0 to 61 Mc/s.
Range approximately: 3 to 8 miles.
Power requirements: Standard 120 v. H.T. and 2 v. L.T.
Ideal for Civil Defence and communications.
BRAND NEW... **59/6**
Calibrated Wavemeter for same 10/- extra.

Send 3d.—28 PAGE CATALOGUE CONTAINING BARGAINS IN VALVES, COMPONENTS AND METERS

HENRY'S RADIO LTD.

5, HARROW ROAD, PADDINGTON, W.2
(Opposite Edgware Road Station) PAD. 1008/9

K

S.C.R. 399 WHOLE INSTALLATION

INCLUDING SHELTER H.D. 17A & 10 KW. PETROL GENERATOR
P.E. 95G AVAILABLE

Also available separately

TRANSMITTER B610E

Frequency range 2 Mc.-18 Mc. Three pretuned channels selected by switch. Frequency control regulated either by manually tuned MASTER OSCILLATOR or crystal controlled oscillator.

Power output 450 w. telegraph, 350 w. telephone.

Power supply 120 v. A.C. 50/60 cycles special auto-transformer 120/220 v. made by Hallicrafters can be supplied additionally.

Tube complement oscillator 6V6, doubler or buffer 6L6, intermediate amplifier 807 (2). Power amplifier 250 TH. HV Rectifier 866A(2). Voltage regulator VT139(3). Audio drive 2A3(2). Modulator 100TH(2). Rectifier 5Z3(2).

Complete with Speech amplifier, aerial tuning unit, tank coils, tuning units, microphone, key, connecting cables.

We guarantee full supply of all replacement parts for a minimum of 5 years after purchase.

P.C.A. RADIO

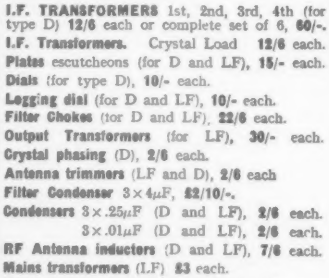
Offices and Works

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

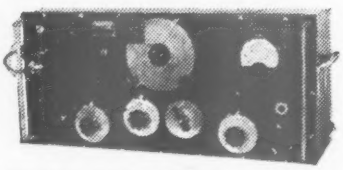
Telephone: RIV 8006/7

BRAND NEW ORIGINAL SPARE PARTS FOR AR88 RECEIVERS.

I.F. TRANSFORMERS 1st, 2nd, 3rd, 4th (for type D) **12/6** each or complete set of 6, **60/-**.
I.F. Transformers. Crystal Load **12/6** each.
Plates escutcheons (for D and LF), **15/-** each.
Dials (for type D), **10/-** each.
Logging dial (for D and LF), **10/-** each.
Filter Chokes (for D and LF), **22/6** each.
Output Transformers (for LF), **30/-** each.
Crystal phasing (D), **2/6** each.
Antenna trimmers (LF and D), **2/6** each
Filter Condenser 3×4μF, **£2/10/-**.
Condensers 3×.25μF (D and LF), **2/6** each.
3×.01μF (D and LF), **2/6** each.
RF Antenna inductors (D and LF), **7/6** each.
Mains transformers (LF) **£3** each.
Medium knobs (for LF and D), **2/6** each.
Small knobs (for LF and D), **2/-** each.



AVOMINORS in leather case, with leads, fully tested, **£5/10/-**. Packing and Carriage 2/6.



MARCONI SIGNAL GENERATOR. T.F.144G. Covering 85 kc/s. to 25 Mc/s. Calibrated and fully guaranteed. Postage and packing 20/-. **£70.**

2 K.V.A. TRANSFORMERS. 230/50 v. output adjustable by rotary switch. Can be easily adapted as a welding transformer. **£15.** Postage and packing 30/-.

R.109A RECEIVERS. Covering 2-12 Mc/s. 6 v. D.C. **£4/5/-.** Carriage paid.

HIGH RESISTANCE HEADPHONES. 4,000 ohms. Brand New, Ex W.D., boxed, Type D.H.R., **11/-** per pair postage 1/6.

LOW RESISTANCE HEADPHONES. Brand new, Ex W.D., boxed, Type C.L.R. and D.L.R.. **5/6** per pair, postage 1/6.

813 (RCA) VALVE. New, originally boxed with guarantee, **£4** each, post paid.

MODULATION TRANSFORMERS (U.S.A., Collins), primary imp. 6,000 ohms. C.T., Secondary 6,000 ohms., 20W., **9/6** each.

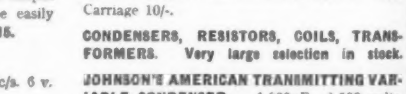
SPARES for AR77E. Bandspread Dia **8/-**. Clean dial window sheet **3/-**. Terminal boards **3/-** each. 10in. shaft for switch **1/-**. Band indicator shutter plate **3/8**. Each item 1/- postage.

AMERICAN VALVE TESTER Model 314 Individual lever switches for each tube element. Roll Chart for American type valves. 220/30 V. A.C. Brand new in nice wooden case with leather handles. Full instruction booklet. **£10.** Carriage 10/-.

CONDENSERS, RESISTORS, COILS, TRANSFORMERS. Very large selection in stock.

JOHNSON'S AMERICAN TRANSMITTING VARIABLE CONDENSER. 1,020pF., 3,500 volts, air gap 080. **17/6,** postage 2/6. 500pF, 3,000 volts, **10/-**, postage 2/-.

SCR522 TRANSMITTER (BC625), including all valves, **45/-**, post free.



AMERICAN HANDY TALKIE. Type B.C.611 including two operating crystals (5-6 Mc. band), **£19/10/-**. Postage and packing 10/-.

Universal call 10 line telephone switchboard as new, fully tested with all accessories, price on application.

P. C. RADIO LTD.
170, GOLDHAWK RD., W.12 **SHEpherds Bush 4946**

PERSONAL CALLERS WELCOME

Best Buy at Britain's

CRYSTAL CALIBRATORS, Mk. 2. Ultra modern miniature design, only 9×7×6½in. Gives 1 Mc/s., 100 Kc/s., and 10 Kc/s marker pips as selected. Requires 60 v. H.T. Controls: On/Off, Modulation On/Off, Adjust 100 Kc/s, Adjust 10 Kc/s. Supplied complete with five 1T4, one 1R5, 1 Mc/s B7G based crystal and headphones. Despatched in specially designed original transit case. **ABSOLUTELY BRAND NEW.** £5/19/6.

MARCONI LOOP AERIAL type 696. A small, compact, enclosed loop. On swivel mount with degree scale. **BRAND NEW.** 69/6. Post 2/6. Ideal for R1155, etc.

RT34/APS-13 AMERICAN 70 cm. TRANSMITTER-RECEIVER. Complete with nine 6AG5, five 6·6, two 2D21, one VR105, and dynamotor. Has 34 Mc/s I.F. strip. **BRAND NEW,** in original cartons. 69/6. Carr. 5/6.

BATTERY CHARGERS. Input 230 v. A.C. Output 12 v. D.C., 1.5 amps. In neat grey metal case, 7×6×5in. **BRAND NEW.** 35/-.

SPEAKERS (Eddystone). 3 ohms, 6½in. diam. In grey wrinkled steel cabinet 9×9×5in. Complete with volume control and transformer for 600 ohms line. **BRAND NEW.** 27/6. Post 2/6.

VHF TRANSMITTERS. BC-950A-130 100-150 Mc/s., 4 channel, crystal controlled transmitter. Complete with valves, 2 of 1625, 2 of 832A, 1 of 815 (modulator). **BRAND NEW.** In original American packing. (Xtals not supplied.) £5/19/6. Carr. 7/6.

RT37/PPN2 BEACON TRANSMITTER-RECEIVER. 214-234 Mc/s. Size 13in. × 10in. × 5in. Contains 5 3A5, 3 1S5, 1 1R5 and 2 2 v. synchronous vibrators. Operates from 2 v. accumulator via 2 built-in vibrapacks. Complete with telescopic mast Antenna system. (9½ft.), lightweight headphones. Technical Manual, super-quality carrying haversack, cords, co-ax cables, plugs, etc. Total wt. 28lb. **BRAND NEW,** boxed. American equipment, 72/6.

MAINS DIMMERS. 300 ohms, 1 amp., 300 watts, twin ceramic formers, 15/-. **CRYSTALS.** 200 Kc/s. American GEC, 10/- each. 100 Kc/s. RCA bars, 15/-.

DUAL PURPOSE TRANSFORMERS (Gresham). Pri. 230/250 v. Secs. 240-0-240 v. 1.5 amps., 5 v. 12.5 amps., 5 v. 1.75 amps. Ideal for ISOLATING TRANSFORMER, to obtain TWO 240 v. 360 watt lines. Potted, oil-filled, 7 × 7½ × 10½in. high. Wt. 50 lb. **BRAND NEW.** £3/10/-. Carr. 10/-.

MAINS ISOLATING TRANSFORMERS (Vortexion). Fully shrouded. For testing A.C./D.C. sets in safety. 230 v. input. Output 230 v. 100 watts, 22/6. Post 2/6. **JACK BOXES.** A small metal box fitted with 9 miniature insulated Igranic jack sockets. **BRAND NEW. SNIP.** 12/6.

AVOMETER Model D. £8-19-6 *(P. & P. 4/-)*

D.C. Volts	A.C. Volts	D.C. Current	A.C. Current
150 mV.	7.5 V.	15 m/A.	75 m/A.
300 mV.	15 V.	30 m/A.	150 m/A.
1.5 V.	75 V.	150 m/A.	750 m/A.
3 V.	150 V.	300 m/A.	1.5 Amps.
15 V.	300 V.	1.5 Amps.	7.5 Amps.
30 V.	600 V.	3 Amps.	15 Amps.
150 V.	750 V.	15 Amps.	
300 V.	1.5 KV.	30 Amps.	Resistance
750 V.			0-1000 ohms.
1.5 KV.			0-10 K ohms.

Thoroughly overhauled. Complete with batteries and instructions. An extremely robust meter at a very reasonable price.

SANGAMO WESTERN Model E772

ANALYSER 10 Gns. *(P. & P. 4/-)*

A.C. and D.C. Volts	D.C. Current	A.C. Current
2.5 V.	100 micro-Amps.	0.5 Amp.
10 V.	1 milli-Amp.	1 Amp.
50 V.	10 milli-Amps.	5 Amps.
250 V.	50 milli-Amps.	
1,000 V.	100 milli-Amps.	Resistance
	500 milli-Amps.	0-100 ohms.
		0-1,000 ohms.
Output meter		0-100 K ohms.
		0-10 Megohms.

Supplied in neat black Rexine covered carrying case, complete with all batteries and instructions. Thoroughly overhauled and in perfect working order.

COMBINATION VALVE TESTER & MULTIMETER Brand new, ex-U.S.A. For valve, circuit, capacity, and other testing purposes. In neat black crackled metal case with lid and carrying handle. 18×7½×5½in. Employs 4in. square-faced 100 micro-Amp. meter. Ranges: 0 to 10, 50, 250, 500 and 1,000 v. A.C. and D.C.; 0 to 500, 150 K, 1.5 Meg., and 15 Megohms; 0 to 1, 10, 50 and 250 milli-amps. D.C. Valve tester has provision for "short" tests and inter-electrode voltages and currents. Supplied complete with instructions, valve charts and batteries, ready for use on A.C. mains. £14/19/6. Carr. 7/6.

AVO LC AND R. BRIDGES. Capacity 5 pFd. to 50 mFd.; Resistance 5 ohms to 50 Megohms. Inductance can be measured against external standard. Balance is indicated on a meter, which can be used as a valve voltmeter from .1 to 15 volts. Leakage test and Power Factor scale. For use on A.C. mains, tested and guaranteed £7/19/6. Post 3/6.

AMERICAN MULTIMETERS

A good general purpose portable meter by Precision, U.S.A. Basic 9½D 300 micro-Amps. Ranges: A.C. and D.C. volts 0 to 12, 60, 300, 600, 1,200 and 6,000; D.C. milli-Amps. 0 to 1.2, 12, 60 and 600; Ohms: 0 to 5 K, 500 K, and 5 Meg.; −10 to +16 dB. In polished wooden case with carrying handle and compartment for leads, etc. Size 7½×7½×5½in. Complete with batteries, tested and guaranteed. £6/19/6. Post 3/-.

AMERICAN METERS. Brand new Westinghouse, flush, panel mounting, circular 2in. scale, 0-5 milli-Amps. with blank black scale. Boxed, 8/6. Post 1/-.

MULLARD C & R BRIDGES

0.1 ohms to 10 Megohms in 4 ranges: 10 pFd to 10 mFd. in 3 ranges; Calibrate, Open Bridge, and % ranges. For 100-250 v. A.C. mains. Tested and guaranteed. £7/10/-. Post 2/6.

ADMIRALTY POWER UNITS. Equivalent to AM234. Input 200-250 v. 50 c/s. A.C. mains. Outputs 240 v. D.C. 125 m/Amps., and 6.3 v. A.C. 6 amps. Dual purpose 24in. panel mounted 300 v. meter reads input and H.T. volts. Double smoothing with paper capacitors. Standard 19in. rack mounting. **BRAND NEW.** 79/6. Carr. 7/6.

MEGGERS

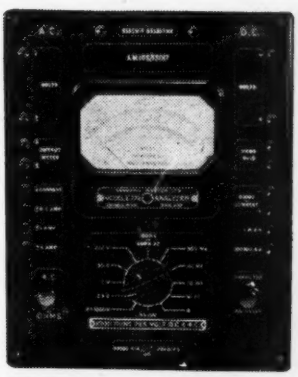
Evershed and Vignoles Wee Meggers, 500 volts. Complete in leather case, with leads and instruction booklet. **BRAND NEW,** £12/10/-. Ditto, but 100 volts. **BRAND NEW,** £6/10/-.
INSULATION TESTERS, by Record Electric. 0-50 Megohms, 500 volts. Tested and guaranteed **ONLY** £8/10/-.

MINIATURE 3/3 IF STRIPS. For FM tuner described in "Practical Wireless," Complete with 3 of EF91, 2 of EF92, and 1 of EB91. A fresh release enables us to offer these once again. **BRAND NEW.** Complete reprint of conversion instructions and circuit supplied free. With circuit 42/6, OR less valves, 12/6. Post, either, 2/6.

TRANSMITTER TYPE 36

Complete 110-250 v. A.C. mains operated transmitter for speech, CW, or MCW. Covers 10-80 Mc/s. (10-15-20 metre Ham Bands) but only 10-40 coils supplied. Crystal or stabilised VFO. Push-pull 807's plate and screen modulate parallel 807's. Supplied tested, ready to use, with connectors, 16 valves, handset, operating instructions and circuit. £12/10/-. Carriage England and Wales 30/-.

£12.10.0 →



TRIPLETT MULTIMETERS

25 Ranges: 0 to 5, 25, 100, 250, 1,000, and 5 kV D.C. (20,000 OPV); 0 to 5, 25, 100, 250, and 1,000 v. A.C. (1,000 OPV); 0 to 50 microA, 1, 10, 100 and 500 mA. 1 and 5 amps. D.C.; 0 to ½, 1, 5 and 10 amps. A.C.; 0 to 1,000, 100 K, and 10 megohms. Square meter, size 4 × 4in. Contained in 11½ × 8 × 5½in., wooden case, weight 10lb. Supplied complete with instruction book, batteries, leads and special high voltage leads. **BRAND NEW** ready for use and fully guaranteed. 15 gns. Post 5/-.

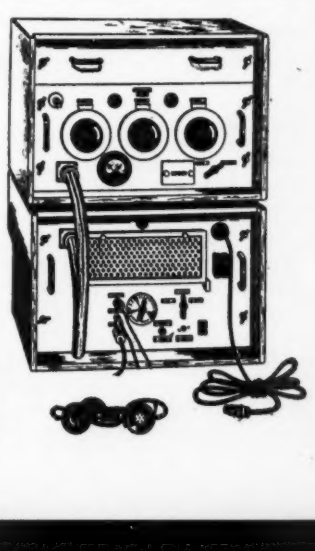
VIBRATOR PACKS. Input 6 v. D.C. Output approx. 100 v. D.C. at 30 m/Amps., fully smoothed and R.F. filtered. Size 6½ × 5 × 2in. Fitted with Mallory 629C vibrator. **BRAND NEW.** Boxed. 12/6.
ANOTHER, but 200 v. D.C. 100 m/Amps. With OZ4 valve and vibrator. **BRAND NEW.** Boxed 25/-.

RCA OUTPUT TRANSFORMERS

As used in MI-11220 Amplifier. Primary for push-pull 6L6's. Secondaries 5, 7.5, 15, and 600 ohms, and tertiary for NEB. 25 watts power rating. Potted construction, with tag connections. Full circuit of RCA amplifier supplied. **BRAND NEW,** 27/6.

HEAVY DUTY SLIDER RESISTORS. 0.4 ohms, 25 amps., 250 watts, worm drive, 7/6. 10 ohms, 3.5 amps., worm drive, 10/6. 1 ohm, 12 amps., 150 watts, 7/6.

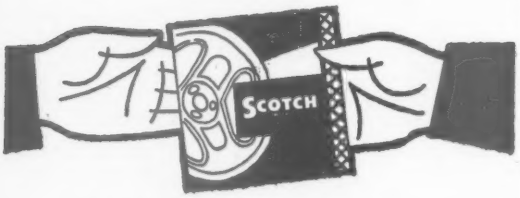
MINIATURE STC RELAYS. 250 ohms coil. DP C/O (double silver contacts) 1½ × ¾ × ¾in. Wt. one oz. 6 v. operation. 7/6.



CHARLES BRITAIN (Radio) Ltd.
11 UPPER SAINT MARTIN'S LANE
LONDON, W.C.2. *TEMple Bar 0545*
One Minute from Leicester Sq. Station (up Cranbourn St.)
Shop Hours: 9-6 p.m. (9-1 p.m. *Thursday*) *Open all day Saturday*

MORE

AND MORE



AND MORE

Recordists are buying Scotch Boy Magnetic Tapes for HIGHER FI at LOWER prices

BIGGEST range.
Acetate, PVC and Polyester; all silicone lubricated to increase the life of your tape-recorder and assure continued perfect clarity.

FINEST quality.
High sensitivity and freedom from distortion guaranteed by scientific production control.

BEST value.
Possible only because of 3M research and large scale production.

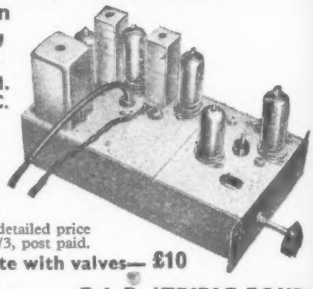
BRITAIN'S LOWEST PRICED RECORDING TAPE	
111A — STANDARD ACETATE	
3" — 200ft.	6/3
5" — 600ft.	16/-
5½" — 850ft.	22/-
7" — 1200ft.	27/-
A POLYESTER TAPE—AT A P.V.C. PRICE	
150 — EXTRA PLAY POLYESTER	
3" — 300ft.	9/6
5" — 900ft.	28/-
5½" — 1275ft.	35/-
7" — 1800ft.	50/-

TRADE MARK
SCOTCH BOY
MAGNETIC TAPE DOES THE JOB BETTER!

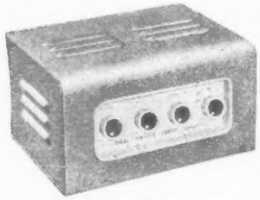
PRODUCT OF 3M RESEARCH

MINNESOTA MINING & MANUFACTURING COMPANY LTD.,
3M HOUSE · WIGMORE STREET · LONDON W.1
AND BIRMINGHAM · MANCHESTER · GLASGOW
WORLD'S LARGEST MANUFACTURERS OF MAGNETIC TAPES

HOME RADIO OF MITCHAM
for the Jason
'MERCURY'
switch-tuned F.M. tuner with A.F.C.



F.M. reception at its simplest and best; the programme you want at the turn of a switch, with automatic frequency control to keep you spot-on the station all the time. Full constructional detailed price list sent by return, price 2/3, post paid.
Kit of parts, complete with valves— £10



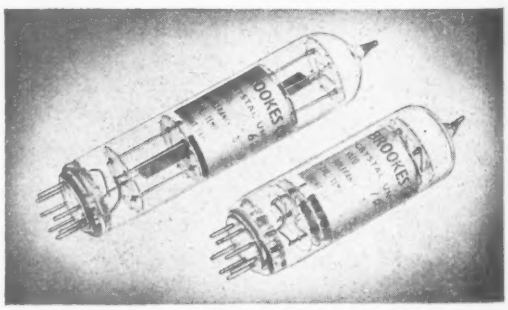
E.A.R. 'TRIPLE FOUR' AMPLIFIER
Six watt ultra linear push-pull output. Independent bass, treble and equalisation controls. Power take-off for F.M. tuner. Ideal for home High Fidelity reproduction. A.C. mains.
PRICE **£11.11.0**

STOP PRESS
Available now — the new Repanco MINISEVEN, 7-transistor superhet pocket portable with guaranteed loudspeaker results on internal aerial. Send 1/9 for full constructional details.

High Stability Resistors
We are pleased to announce that we now stock a complete range of 97 different preferred values of ½ watt 5% high quality—high stability resistors. Price, only 9d. each (add postage).

HOME RADIO (MITCHAM) LTD.
187 LONDON ROAD, MITCHAM, SURREY. Phone: MITcham 3282

BROOKES *Crystals*



mean DEPENDABLE frequency control

Illustrated above are
Left:
Type G.2 Crystal Unit. Frequency 62 kc/s.
Right:
Type G.1 Crystal Unit. Frequency 100 kc/s.

ALL Brookes Crystals are made to exacting standards and close tolerances. They are available with a variety of bases and in a wide range of frequencies. There is a Brookes Crystal to suit your purpose—let us have your enquiry now.

BROOKES
Brookes Crystals Ltd
Suppliers to Ministry of Supply, Home Office, B.B.C., etc.
181/3 TRAFALGAR ROAD, LONDON, S.E.10
Phone: GREenwich 1828 *Grams:* Xtals, Green, London

CATALOGUE FOR 1958 & HANDBOOK

L/P RECORD LIBRARY

POST 3/- FREE

- The only comprehensive selective catalogue of Classical L/P Records—listing only recordings recommended by the Critics.
- Nearly 4,000 discs listed (as already available to Library members).

Also sections on:—

- The care of Long Playing Records.
- The Reproduction of Long Playing Records.
- A Basis for a Record Collection (100 Recommended L/Ps).

If (like us) you love good music and find pleasure in good records, you will (we feel certain) be finding it increasingly difficult to choose from among the many fine L/Ps—just which to add to your collection. Now comes the perfect solution—the chance to borrow the pick of the L/Ps to play AT HOME—ON YOUR OWN GRAMOPHONE. FULL DETAILS OF THIS LIBRARY SERVICE (which costs approx. 1/- per week each L/P borrowed) are included in our Catalogue & Handbook—

THE L/P RECORD LIBRARY CLASSICAL CATALOGUE AND HANDBOOK FOR 1958

COSTS ONLY 3/- POST FREE (50 cents U.S.A.)

(For Library details *without* Catalogue, please send large s.a.e. 2½d.)

From: **THE LONG PLAYING RECORD LIBRARY, SQUIRES GATE STATION APPROACH, BLACKPOOL, LANCS.**

?? YOUR QUESTION ANSWERED ??

We are frequently asked:—

In what condition are the Library records?

Records loaned by the L/P Record Library are in first-rate condition and worthy of reproduction on the finest high fidelity equipment. The very large majority are in **mint** or near-mint condition.

We can only suggest—take out a trial membership for yourself and see!!

FACTORY FRESH — THE LONG PLAYING — FFSS RECORD LIBRARY — SALES SERVICE

FFSS STANDS FACTORY FRESH FOR SALES SERVICE

FFSS announces a new, high quality, Sales Service **operated exclusively by The L/P Record Library.** We have long realised that such a service was badly needed by the audio engineer and high fidelity enthusiast.

- **FFSS** indicates that the record purchased is not only a brand new, guaranteed unplayed, factory copy but that it has been obtained from the makers by special order for the purchaser. Besides being unblemished, the disc is also **as up-to-date a pressing as is currently available in this country.** This is tremendously important when it is realised that many of the older L/Ps (especially Decca) are currently being re-cut from the master-tapes by the manufacturers **with marked improvement in reproduction.** **FFSS** covers all record labels available in this country **except H.M.V.**
- **INSPECTION** before dispatch and only good pressings are chosen.
- **ADVICE** is given when needed and we can supply the best available recording.
- **STYLUS REPLACEMENT** Diamond or Sapphire—by return of post in most cases.
- **EQUIPMENT AND ACCESSORIES.** Our Reproduction Specialist Mr. C. T. Salisbury will be only too happy to advise personally on the best available within YOUR price range.

WHY NOT MAKE A TRIAL ORDER NOW...
(or send for more details enclosing large s.a.e. 2½d.)

TRANSISTOR A.F. AMPLIFIERS

A new book for engineers and students

by D. D. Jones, M.SC., D.I.C.
and R. A. Hilbourne, B.SC.

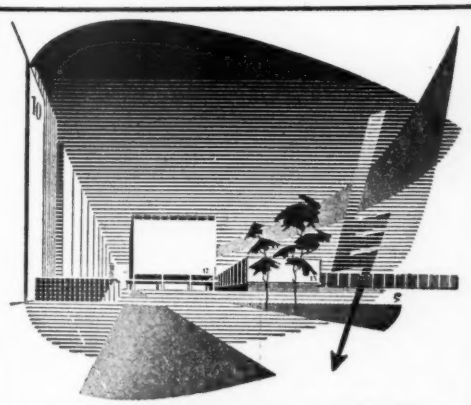
Deals systematically with the design of transistor audio-frequency amplifiers, and gives the circuitry and design details of a versatile range of amplifiers including both those for high fidelity reproduction and for public address systems with undistorted outputs up to 20 watts.

152 pp. 94 diagrams. **21s. net by post 21s. 10d.**

from leading booksellers

Published for "Wireless World" by

Iliffe & Sons Ltd., Dorset House, Stamford St., London S.E.1.



HANNOVER

the most important Market of the

ELECTRICAL INDUSTRY

for heavy equipment and consumer goods

GERMAN INDUSTRIES FAIR

APRIL 27 – MAY 6, 1958

Information and catalogues from :

SCHENKERS LTD., Royal London House, 13, Finsbury Square, London, E.C.2.

VALVES

Guaranteed All Tested Before Dispatch.

AC6PEN...	6/6	EF36	6/-	KK32	25/-	TP25	27/10	X78	22/3	6BG6G	24/4
AC/TH1	34/9	EF37A	12/-	KLL32	8/6	U22	8/-	X79	11/6	6BH6	16/-
ATP4	3/6	EF39	6/6	KT24	5/-	U24	12/6	Y63	9/-	6BJ6	9/-
AZ31	17/5	EF40	13/6	KT33C	10/-	U25	14/6	Z309	11/6	6BR7	11/6
CBL31	24/4	EF41	9/9	KT36	27/10	U37	27/10	Z359	11/6	6BW6	8/6
CCH35	24/4	EF42	14/-	KT55	13/6	U45	15/-	Z759	11/6	6BW7	10/-
CL33	20/2	EF50	4/-	KT66	15/-	U403	17/5	1A3	3/6	6C4	7/-
CY31	17/5	EF54	6/-	KTW63	7/6	U404	11/10	1A5GT	6/-	6C5GT	6/6
DAF96	10/6	EF55	10/-	KTZ41	8/6	U801	31/4	1A7	12/6	6C6	5/-
DF96	10/6	EF80	9/-	ME91	7/6	UABC80	18/1	IC2	11/6	6C8G	5/-
DK96	10/6	EF85	9/-	MH4	7/6	UAF42	10/6	IC5GT	12/6	6CD6G	31/4
DL96	10/6	EF86	13/6	MH41	7/9	UB41	9/6	ID6	12/6	6CH6	7/6
DM70	8/6	EF89	10/-	N37	18/1	UBC41	10/-	IH5GT	10/6	6D6	5/-
EA50	1/6	EK32	8/6	N78	12/6	UBF80	9/6	IL4	6/6	6F6G	7/6
EABC80	10/-	EL32	5/6	P61	3/6	UBF89	18/1	ILD5	3/6	6F6M	7/6
EAC91	7/6	EL33	20/2	PCC84	10/-	UCC84	20/11	IN5	10/6	6F13	14/-
EAF42	10/6	EL38	27/10	PCF80	13/6	UCF80	23/-	IR5	8/-	6F15	14/-
EB34	2/-	EL41	10/6	PCF82	12/6	UCH42	10/6	IS4	10/6	6F33	5/6
EB41	9/-	EL42	11/6	PCL82	14/6	UCH81	11/6	IS5	7/6	6G6G	4/6
EBC33	7/6	EL84	10/6	PCL83	14/6	UCL82	23/-	IT4	7/6	6H6	2/6
EBC41	10/6	EM34	10/-	PL38	27/10	UCL83	25/9	2C26	2/6	6H6GT	2/6
EBF80	10/6	EM80	10/6	PL81	15/-	UF41	10/6	2X2	4/6	6J5GT	5/6
EBF89	18/1	EM81	11/6	PL82	9/6	UF80	19/6	3A4	7/-	6J5M	6/6
EBL21	24/4	EY51	13/6	PL83	11/6	UF85	19/6	3D6	5/-	6J6	6/-
EBL31	24/4	EY86	17/6	PP225	3/11	UF89	16/-	3Q4	9/-	6J7G	6/-
EC52	6/-	EZ40	9/-	PX25	12/6	UL41	10/6	3Q5GT	9/6	6J7M	9/-
ECC40	12/6	EZ41	10/-	PY80	9/-	UL44	27/10	3S4	8/-	6K6GT	7/-
ECC84	10/3	EZ80	8/9	PY81	10/-	UL46	24/4	3V4	9/-	6K7G	5/-
ECC85	9/6	EZ81	11/10	PY82	8/6	UL84	10/6	4D1	3/-	6K7GT	7/-
ECF80	13/6	EZ90	8/-	PY83	10/-	UU6	20/11	5R4GY	9/6	6K7M	6/9
ECF82	12/6	E1148	2/-	PZ30	20/11	UU8	27/10	5U4G	8/-	6K8G	8/6
ECH21	24/4	GZ32	12/-	PEN4DD	27/10	UU9	8/6	5Y3G	8/-	6K8GT	9/6
ECH35	10/6	H30	5/-	PEN25	5/-	UY41	8/6	5Y3GT	8/-	6K25	20/11
ECH42	10/-	HL23DD	8/6	PEN44	27/10	UY85	10/-	5Z4G	10/-	6L6G	9/-
ECH81	9/-	HL92	12/6	PEN46	7/-	VP2B	8/-	6A7	13/-	6L7	7/6
ECL80	13/6	HN309	13/6	PEN220A	4/-	VP23	6/6	6A8G	10/-	6N7	7/6
ECL82	13/6	K40N	9/-	PENA4	15/-	VP41	8/6	6AC7	6/6	6P25	13/6
EF22	8/6	KF35	8/6	QP21	7/6	VR105/30	6/6	6AG5	5/6	6P28	27/10
				R16	27/10	VR116	4/-	6AK5	6/6	6Q7GT	9/-
				R18	14/-	VR150/30	9/-	6AL5	6/6	6SA7GT	8/-
				R19	14/6	VS70	3/-	6AM6	9/-	6SG7	7/6
				SP41	3/-	VU120A	3/6	6AQ5	7/6	6SH7	6/-
				SP61	3/-	VU39(MU12/14)		6AT6	8/6	6SJ7	8/6
				SP220	3/11		8/9	6QU6	10/6	6SK7	6/-
				T41	24/4	VU111	2/6	6B4	5/-	6SL7GT	8/-
				TH2	9/-	W77	8/6	6B8G	4/-	6SN7GT	7/6
				TH30C	8/-	W729	13/6	6BA6	7/6	6SQ7	9/3
				U10	10/6	X65	12/6	6BE6	8/-	6U4GT4	14/-
										6U5/6G5	8/6
										6U5G	8/6
										6U7G	8/6
										6V6G	7/-
										6V6GT	7/-
										6V6M	7/-
										6X4	7/6
										6X5G	7/-
										6X5GT	7/-
										6/30L2	12/6
										7B7	8/6
										7C5	8/-
										7C6	8/-
										7H7	9/-
										7Q7	9/-
										7S7	9/6
										7Y4	8/6
										8D2	2/9
										9D2	3/6
										10F1	27/10
										12A6	6/6
										12AH8	11/6
										12AT6	10/6
										12AT7	9/-
										12AU7	7/6
										12AX7	8/6
										12BA6	9/-
										12BE6	10/-
										12BH7	11/6
										12C8GT	8/-
										12H6GT	3/-
										12J5GT	4/6
										12J7GT	10/6
										12K7GT	8/6
										12K8GT	13/6
										12Q7GT	8/6
										12SC7	2/6
										12SG7	7/6
										12SH7	5/6
										12SJ7	8/-
										12SK7	6/-
										12SL7	8/-
										12SN7GT	17/6
										12SQ7	8/6
										14S7	14/6
										15D2	7/9
										19BG6G	24/4
										20D1	16/-
										20F2	24/4
										20P1	27/10
										20P3	20/11
										20P5	20/11
										25A6G	20/2
										25L6GT	10/-
										25Y5G	9/9
										25Z5	10/-
										25Z6	10/-
										27SU	20/11
										30F5	12/6
										30FL1	12/6
										30P4	15/-
										35L6GT	9/6
										35W4	8/6
										35Z4GT	8/-
										35Z5GT	9/-
										42	8/-
										50C5	11/6
										50CD6G	31/4
										50L6GT	8/6
										75	11/6
										77	7/6
										80	8/6
										142BT	3/6
										185BT	34/9
										210DDT	4/6
										210VPT	3/6
										807	6/6
										954	2/-
										955	4/9
										956	3/6
										9001	5/6
										9002	5/6
										9003	5/6
										9004	5/6
										9005	5/6

PACKING AND POSTAGE — 6d. per valve.

SAME DAY SERVICE.

HEADPHONES — MICROPHONES

EX-GOVERNMENT HEADPHONES AND MICROPHONES

C.I.R. low resistance type 120 ohms. ... 7/6 pair
Throat Microphones, American surplus. Complete with strap, lead and plug type T30B ... 3/- set
High Resistance Phones, 4,000 ohms .... 13/6 pair
High Resistance DLR Phones ... 16/- pair

TRANSISTORS

Suitable for audio work yellow and green spot, ea. ... 10/-
red spot, ea. ... 10/-
R.F. for use up to 1.6 mc/s. white spot, ea. ... 15/-
R.F. for use up to 1.5 mc/s. to 8 mc/s. yellow and red spot, ea. ... 21/-

JB gang condensers for transistor working "0" gang 1 or 2 gang 365 PF swing, aluminium vanes, steel chassis.
1 gang 7/6 each; 2 gang 11/6 each. JB "00" (twin gang condenser 208 PF front section 17/6; PF rear section price 9/6 each.

A NEW and UP-TO-DATE T.R.F. KIT

★ BRAND NEW COMPONENTS
★ 3 VALVES—6K7, 6J7, 6V6
★ CONTACT COOLED RECTIFIER
★ PM SPEAKER
★ AC MAINS FULLY ISOLATED.

Circuit Diagram and Full Shopping List, 1/-. Complete Kit down to last nut and bolt, £5/10/- each. Carriage and packing 3/-.

SPECIAL PURCHASE

Sin. P.M. Speaker Units with Output Transformer removed from equipment. 11/6 each.

STENTORIAN LOUDSPEAKERS.

New Miniature Models for use with Transistor Amplifiers, etc., etc. 8.1.75. Diameter 1¾in. Total depth 1in. 3 ohms impedance 28/9 each.

8—2 x 3- Elliptical Speaker. Size 2 1/16 in. x 1 23/32 in. Depth 1 1/16 in. 32/- each

OUR 1957-1958 CATALOGUE IS NOW AVAILABLE TO ALL READERS OF THIS MAGAZINE. 48 PAGES OF COMPONENTS AND EQUIPMENT OF INTEREST TO ALL RADIO ENTHUSIASTS. SEND 1/- IN STAMPS FOR YOUR COPY.

HEATER TRANSFORMERS — Each

230 v. Input 2 volt .5 amps. ... 5/-
230 v. Input 2 volt 3.0 amp. ... 8/3
230 v. Input 4 volt 1.5 amp. ... 5/6
230 v. Input 4 volt 3.0 amp. ... 10/-
230 v. Input 5 volt 2.0 amp. ... 10/-
230 v. Input 6.3 volt .5 amp. ... 5/6
230 v. Input 6.3 volt 1.5 amp. ... 6/9
230 v. Input 6.3 volt 3.0 amp. ... 10/-
230 v. Input 12 volt .75 amp. ... 5/9

PUBLICATIONS

No. 128—PRACTICAL TRANSISTORS AND TRANSISTOR CIRCUITS ★ How to Make Your Own Transistors ★ 48 Pages. 3/6 each.

No. 138—HOW TO MAKE AERIALS FOR TV (Band 1 and 3) and V.H.F. (Band 2). Data for all Channels. Ten different designs for local and fringe areas. 2/6 each.

No. 144—VALVE AND TELEVISION TUBE EQUIVALENTS. ★ Receiving ★ Transmitting ★ Industrial. 5/- each.

No. 140—TELEVISION SERVICING FOR BEGINNERS. ★ 40 Pages of Information. 4/6 each.

No. 142—MODERN TV CIRCUITS AND FAULT FINDING GUIDE. ★ Many interesting Circuits included. 4/6 each.

Reprint No. 6—TV FAULT FINDING. Profusely illustrated wirh Photographs taken from a Televisor Screen. 5/- each.

No. 134—F.M. TUNER CONSTRUCTION, By W. J. May. ★ Easy to Build, Point to Point Wiring ★ Super High Fidelity Response ★ 32 Pages ★ All Components for this Circuit available ex stock. 2/6 each

No. 100—A COMPREHENSIVE VALVE GUIDE, Book No. 1. 5/- each.

No. 121—A COMPREHENSIVE VALVE GUIDE, Book No. 2. (Characteristics and Base Connections.) 5/- each.

No. 103—RADIOFOLDER "A." The Master Colour Code Index for Radio and Television. 1/6 each.

No. 143—A COMPREHENSIVE VALVE GUIDE, Book No. 3. ★ International Edition ★ 1,300 Valves not previously listed are presented. 5/- each.

No 144—VALVE AND TELEVISION TUBE EQUIVALENTS. ★ Receiving ★ Transmitting ★ Industrial. 5 - each.

No. 123—RADIO CONTROLLED MODELS FOR AMATEURS. ★ Boats ★ Aircraft ★ Circuits, etc. 5/- each.

MULLARD—HIGH QUALITY SOUND REPRODUCTION. Includes 30 watt Amplifier, F M. Tuner. Pre Amplifiers, etc. 3/6 each.

G.E.C.—F.M. PLUS TUNER. For the "Nine One Two Plus" 2/6 each.

G.E.C.—"NINE ONE TWO PLUS." Details of High Quality Amplifier for the Home Constructor. 4/- each.

Reprint No. 1—THE INEXPENSIVE CAR RADIO RECEIVER. ★ A Cheap and Efficient Car Radio 1/6 each

Reprint No. 2—FREQUENCY MODULATION TUNER UNITS. ★ Prime and Local Area Reception. 2/- each.

Reprint No. 3—THE ARGONAUT AM/FM MW/VHF TUNER RECEIVER. 2/- each.

Reprint No. 4—THE "EAVESDROPPER." A Miniature Transistor Receiver for local station reception. 1/6 each.

Reprint No. 6—THE RADIO AMATEUR OPERATOR'S HANDBOOK. Essential to the Short Wave Enthusiast. 3/- each.

Reprint No. 7—RECEIVERS, PRE-SELECTORS AND CONVERTORS. Many interesting Circuits for all. 2/6 each.

Reprint No. 8—TAPE AND WIRE RECORDING Contains principles of Tape and Wire Recording—complete constructional details of the Paragon Tape Recorder etc., etc. 3/- each.

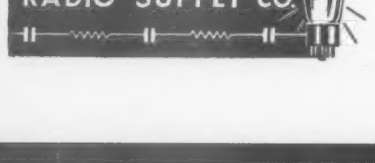
Reprint No. 9—RADIO CONTROL FOR MODEL SHIPS, BOATS AND AIRCRAFT. A Comprehensive Work on this fascinating subject. 8/6 each.

Reprint No. 10—RADIO CONTROL MECHANISMS. A Really Useful Book. 4/6 each.

LOUDSPEAKERS by G. A. Briggs. The Why and How of good reproduction. "Sound" information for the layman and the enthusiast. 7/6 each.

Wearite Manual of the Tape Deck. 3/6 each.

All publications plus 4d. each postage.

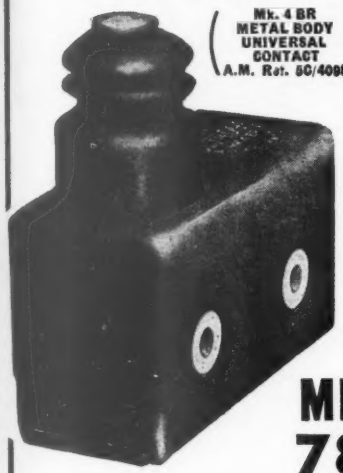


103, LEEDS TERRACE,
WINTOUN STREET,
LEEDS, 7.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/- unless otherwise stated. Minimum C.O.D. fee and postage 3/-.
For full terms of business see inside cover of our catalogue.
Personal Shoppers 9 a.m. to 5 p.m. Mon. to Friday. Saturday 10 a.m. to 1 p.m.

BURGESS

Mk. 4 BR METAL BODY UNIVERSAL CONTACT A.M. Ref. 50/4098



BRAND NEW MINISTRY RELEASE

SPECIAL QUOTATIONS FOR LARGE QUANTITIES

MICRO SWITCHES

78/- PER DOZ. **£25 PER 100**

(mm. quantity)

Compare this remarkable almost half-price offer with manufacturers' prices

MINIATURE RELAYS

SIEMENS TYPE H.96. HIGH SPEED single change-over

1,700Ω + 1,700Ω	27/6
500Ω + 500Ω	22/6
145Ω + 145Ω	19/6
50Ω + 50Ω	17/6
2.2Ω + 2.2Ω	15/6

S.T.C. TYPES

4,700Ω 2-pole change-over 4184 GE	21/6
700Ω 2-pole change-over 4184 GD	19/6
700Ω single heavy-duty make 4186 ED...	18/6

HATTER & DAVIS (RELAYS) LTD, 126 Kensal Road, London, W.10. phone: LADbroke 0666/4640

CHASSIS

Aluminium undrilled with reinforced corner. Available in the following sizes:

6in.	× 4in.	× 2½in.	each	4/6
8in.	× 6in.	× 2½in.	each	6/3
10in.	× 7in.	× 2½in.	each	7/3
12in.	× 3in.	× 2½in.	each	5/9
12in.	× 5in.	× 2½in.	each	6/9
12in.	× 8in.	× 2½in.	each	8/6
14in.	× 3in.	× 2½in.	each	6/-
14in.	× 9in.	× 2½in.	each	12/-
16in.	× 6in.	× 2½in.	each	8/6
16in.	× 10in.	× 2½in.	each	14/-

All are four-sided—ideal for radio receivers, amplifiers, power packs, etc.

COPPER WIRE

TINNED COPPER WIRE—All 4 oz. reels.

16 S.W.G. ..	2/6	24 S.W.G. ..	3/-
18 S.W.G. ..	2/7	26 S.W.G. ..	3/3
20 S.W.G. ..	2/9	28 S.W.G. ..	3/5
22 S.W.G. ..	2/10	30 S.W.G. ..	3/9

ENAMELLED COPPER WIRE—All 4 oz. reels.

16 S.W.G. ..	2/6	30 S.W.G. ..	3/3
20 S.W.G. ..	2/6	32 S.W.G. ..	3/7
22 S.C.G.W. ..	2/9	34 S.W.G. ..	3/9
24 S.W.G. ..	2/11	36 S.W.G. ..	3/11
26 S.W.G. ..	3/-	38 S.W.G. ..	4/3
28 S.W.G. ..	3/1	40 S.W.G. ..	4/7

SOLID DILECTRIC CONDENSERS. .0001, .0002, .0003, .0005 ..... each 4/6

EMSO TYPE TUNING INDICATORS ESCUTCHEON ..... each 2/-

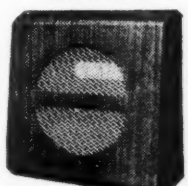
AVO MINOR CASE with carrying strap each 7/6

THE BRAYHEAD TURRET CONVERTOR. Comprehensive installation instructions, plug in facilities for over 600 popular models of T.V. sets of standard I.F. ranges. Price ..... each £7/7/- Illustrated leaflets available. Adaptors. each 7/6

Implosion Guards for 17in. tubes outside dimensions 17½ × 13½in. ..... each 7/6
Brown Escutcheon (postage) 3/-

WB "STENTORIAN."
Model HF 812 Die cast chassis .. each 84/6
Model HF 1012 Die cast chassis .. each 99/9
Universal speech coils.

LOUDSPEAKER CABINETS



This attractive walnut-finished cabinet is available for 6½in. or 8in. speaker units. Metal speaker fret, complete with back and rubber feet.
6½in. type. Measures 8½in. × 8½in. × 4½in. at base. Price 17/6 each.
8in. type. Measures 10½in. × 10½in. × 5in. at base. Price 21/6 each.
5in. type. Very similar design. Price 16/6 each. Postage, any type, 2/- each.

CO-AXIAL CABLES ETC.

Aerialite Aeriaxial 597, semi airspaced 9d yd.
Ashton Co-axial cable solid ..... 6d. yd.
Ribbon feeder (flat), 300 ohms .... 6d. yd.
12 Yaxley Type Switches, various combinations All brand new ..... doz. 9/-
Full range condensers available from stock. Cardboard covered wire ended types.

TCC 10 mfd. 450 v.	1/11
Dubilier 8 mfd. 500 v.	2/9
BEC 8 × 8 mfd. 450 v.	4/-
BEC 16 mfd. 450 v.	2/3
BEC 16 × 8 mfd. 450 v.	4/-
BEC 16 × 16 mfd. 450 v.	4/6
BEC 32 mfd. 450 v.	3/-
BEC 32 × 32 mfd. 350 v.	4/6
Dubilier 16 × 16 mfd. 500 v.	5/-
Dubilier 8 × 8 mfd. 500 v.	4/-
Dubilier 16 × 8 mfd. 500 v.	4/-

Standard Can Types:

24 × 24 × 16 mfd. 350 v.	3/9
32 × 32 MA 450 v.	6/6
60 × 60 mfd. 350 v.	4/6

These are just a few of the types—good stocks of low voltage electrolytics, etc., etc.

LOUDSPEAKER UNITS

Make	Type	Size	Price
Plessey	Square	3in.	19/6 each
Lectrona, Plessey	Round	5in.	17/6 each
Goodmans, Plessey	Round	6½in.	18/6 each
Goodmans, R. & A.	Round	8in.	19/6 each
Plessey, R. & A., Elac	Round	10in.	25/6 each
Elac	Elliptical	7in. × 4in.	19/6 each
Elac	Elliptical	10in. × 6in.	25/6 each

All the above are PM units with 2 to 3 ohms speech coils.

RTC 12in. heavy duty 20 watts model 15 ohms Speech Coil £5 5 0
5in. Mains Energised Speaker £1 0 0

6½in. Mains Energised Speaker 17 6
8in. Mains Energised Speaker £1 1 0
All have field coils of approx. 600 ohms.

SPECIAL OFFER
Just a few 8in. units by Goodmans and Lectrona fitted with standard output transformer ..... £1 1 6 each
8in. P.M. Speaker Units with Output Transformer removed from equipment 11/6 each

OSMOR BAND 1 FILTER
Reject B.B.C. breakthrough on your ITA Station ..... each 10/-

WESTINGHOUSE RECTIFIERS

14A 86 ..... each	13/6
14A 97 ..... each	15/6
14A 100 ..... each	15/-
WX 6 ..... each	2/-

Improve your own HiFi Sound System with T.S.L. Lorenz LPH 65 Treble Speaker each 39/6

Miniature I.F. Transformers, 465 KC/S 9/- pair

Standard I.F. Transformers, 465 KC/S 12/- pair

Standard I.F. Transformers, 100/127 KC/S 12/- pair

Mains Neon Tester Screwdriver Ends each 4/6

Pifco "All in one" Raidometer each 32/6

Acos Mic 39-1 complete with stand each 105/-

Acos Mic 35-2 complete with stand each 26/6

Teletron Band III Mark II Convertor Coil Set Cascode Circuit using PCC84 and PCF80 valves.
Price with circuit ..... 17/6 each

MAINS TRANSFORMERS

3 Way Mounting Type.

MT1
Primary: 200-220-240 v. Secondaries: 250-0-250 v. 80 m/A 0-6.3 v. 4 amp. 0-4 v. 2 amp. Both tapped at 4 v., 21/9 each.

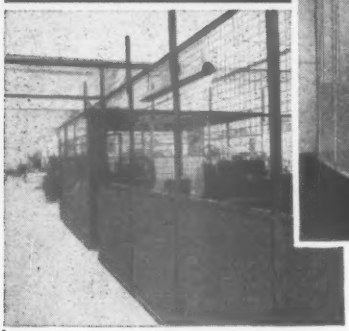
MT2
Primary: 200-220-240 v. Secondaries: 350-0-350 v. 80 m/A 0-6.3 v. 4 amp. 0.5v. 2 amp. Both tapped at 4 v. 21/9 each.

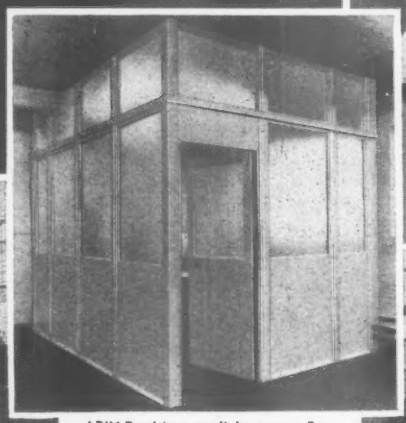
MT3
Primary: 200-220-240 v. Secondary 30 v. 2 amps. Tape at 3 v., 4 v., 6 v., 8 v., 9 v., 10 v., 15 v., 18 v., 20 v., 24 v., 21/9 each. Postage and Packing please add 2/- per transformer.

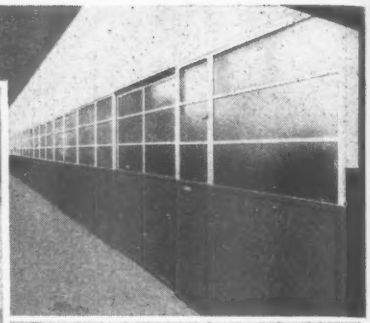
See opposite page for our terms.

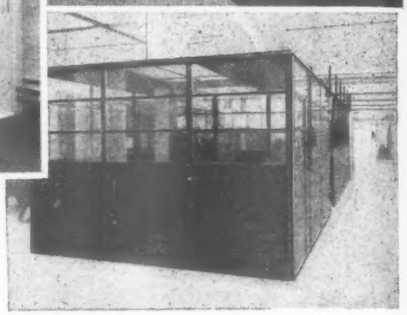
ALPHA RADIO SUPPLY CO., 103, LEEDS TERRACE, WINTOUN ST., LEEDS, 7

ABIX STEEL PARTITIONING *for* OFFICE or FACTORY









ABIX Partitions are light, strong, fire-resisting and easy to erect. Manufactured in standard units for quick installation, easy removal or extension to existing screens. We will be pleased to help and advise you on any partitioning problem.

OTHER ABIX PRODUCTS : Steel Cycle Stands, Clothes Lockers, Material Racks, Slotted Angles (Junior, Universal, Senior), Car and Cycle Shelters, Tool Lockers, Adjustable Steel Shelving.

ABIX

please write for fully illustrated Catalogue W/W2 to :

(METAL INDUSTRIES) LIMITED

STEEL EQUIPMENT FOR OFFICE AND FACTORY

Phone : Molesey 4361/3 **POOL ROAD, WEST MOLESEY, SURREY** *Grams : Abix, East Molesey*

EDDY'S (NOTTM.) LTD.

(Dept. W.W.)

172, ALFRETON RD., NOTTINGHAM

THIS MONTH'S SPECIAL BARGAINS

SINGLE PIECE THROAT MIKES 1/- each. Post 6d. each extra. Could be used for Electrifying Musical Instruments.

MIDGET BATTERY ELIMINATORS. To convert all types battery portables (please state make and model No.) to mains operation. 57/6. Post, etc., 2/6.

ACOS CRYSTAL MIKE INSERTS 4/3 each. High quality, can be used for tape recorders, musical instruments, baby alarams, etc. Post, etc. 6d. each extra.

Any parcel insured against damage in transit. 6d. extra.

Surplus, New & Guaranteed **VALVES** All tested before despatch.

Post, etc. 6d. per valve extra. Over £3. Post Free.

1R5	7/11	6X4	6/6	35A5	10/11	EF80	9/11
1S5	7/3	6X5GT	7/11	35Z4G	7/6	EF91	7/11
1T4	7/3	7B7	8/11	35W4	7/6	EL41	9/11
3Q4	9/-	7C5	8/11	807	4/11	EL84	9/11
3Q5GT	9/11	7C6	8/11	954	1/6	EY51	11/6
3S4	8/6	7H7	8/11	955	3/11	EY86	15/11
3V4	8/6	7S7	8/11	956	2/11	EZ80	8/3
5U4G	6/6	7Y4	7/11	958	3/11	EZ81	9/6
5Z4G	9/11	10F1	15/11	AZ1	12/11	GZ32	12/6
6B8G	3/11	12AH7	7/11	EB91	6/6	MU14	8/6
6BA6	6/6	12AT6	9/11	EBC41	9/6	PCC84	9/6
6BJ6	7/6	12AH8	9/11	EBF80	9/6	PL81	16/11
6F1	13/11	12K7G	7/6	ECC81	8/11	PY80	8/6
6F13	13/11	12K8GT	12/11	ECC82	8/11	PY81	8/6
6F15	13/11	12Q7G	7/6	ECC83	8/11	PY82	8/6
6J5G	3/11	12SJ7	7/6	ECC84	10/6	KT33C	8/6
6K7G	2/11	12SK7	7/6	ECC85	9/6	UCH42	8/11
6K8G	7/11	12SN7	19/11	ECH42	9/11	U25	13/6
6L6G	5/11	14S7	15/11	EF40	13/11	UL41	9/6
6SK7	7/11	25Z4G	9/11	EF41	9/6	UY41	7/6
6SN7	7/11						

S.A.E. with all enquiries.

TECHNICAL TRADING CO.

SIGNAL GENERATORS, Type TF517, £9. B.S.R. L.F. SIGNAL GENERATORS. £12/10/-

4 SPEED CHANGERS **STAAR GALAXY 4-SPEED AUTOCHANGERS.** New look, lightweight Turnover Sapphire Head. (Listed £12/16/-). Makers' sealed cartons. This year's bargain. Post 3/-. **£3.19.6!**

13 CHANNEL CONVERTORS ! For T.R.F. or Superhet Receivers. Famous Make. 3-position switch, fine tuner, and 9 quick-set trimmers. Give any 3 channels, T.R.F. Band I, Superhet Band III. Output direct to aerial socket. Beautiful Bakelite case with PCC84, PCF80, £3/15/-.

12 VOLT 3-4 AMPS. RECTIFIERS. 9/6 to £5 doz. Cossor Wobbulators, £9/10/-

GUARANTEED T.V. TUBES ! (EX EQUIPMENT)

12in. (MW31-74, 3/31, etc.)	£5. 5.0
14in. (MW36-24, 4/14, etc.)	£4.10.0
17in. (MW43-64, 4/15, etc.)	£6.10.0
17in. (CRM171 only)	£5. 0.0

(All guaranteed 6 months) (carr. & ins. 12/6)

GERMANIUM CRYSTAL DIODES, famous make, tested, 9d., p. & p. 3d., 8/- doz.

TRANSISTORS ! RED SPOT (UP TO 800 kcs.) GUARANTEED 7/-

TRANSISTORS ! WHITE SPOT (UP TO 2.5 mcs.) GUARANTEED 14/-

GUARANTEED RADIO VALVES, BOXED, 24 HOUR SERVICE

5U4G	6/6	6L6G	8/-	12Q7GT	7/6	ECF80	12/-	KTW63	8/-
5Z4	9/-	6L7	6/-	25L6GT	8/6	ECF82	12/-	P61	2/6
6AC7	5/6	6SA7M	7/-	35Z4GT	7/6	ECH42	9/6	PCC84	9/-
6A8	9/-	6SG7M	5/6	80	7/6	ECL80	13/6	PCC85	11/6
6AL5	5/6	6SJ7M	7/6	83	7/6	EF36	4/-	PCF80	12/6
6AM6	7/6	6SK7GT	5/-	807(BR)	3/9	EF37	7/-	PCF82	11/-
6BA6	6/6	6SN7GT	5/9	807(AM)	5/6	EF37A	8/-	PEN25	5/-
6BE6	8/6	6U4GT	12/6	C1	9/6	EF39	5/-	PL82	9/-
6C4	4/9	6V6G	6/-	C1C	9/6	EF50(BR)	3/6	PL83	11/-
6C6	4/6	6V6GT	6/6	EA50	1/6	EF50(AM)	4/9	PY80	8/6
6D6	4/6	6V6M	6/6	EB34	1/6	EF80	11/-	PY81	8/6
6H6	2/-	6X4	6/-	EB91	5/6	EF85	7/-	PY82	8/6
6J5M	5/-	6X5GT	5/-	EBC33	7/-	EF89	9/6	SP4B	9/6
6J5GT	4/6	7B7	7/6	EC52	5/-	EF91	7/6	SP41	2/6
6J5G	3/-	7C6	7/6	ECC31	9/6	EF95	8/6	SP61	2/6
6J6	4/6	12A6	4/-	ECC81	8/-	EL32	4/6	U22	7/6
6J7G	5/-	12A7M	6/6	ECC82	6/6	EL91	4/-	U52	6/6
6K7G	4/6	12AT7	8/-	ECC83	8/6	EZ40	8/-	UCH42	9/6
6K7GT	5/6	12AU7	6/6	ECC84	10/6	EZ80	7/6	UY41	8/-
6K7M	6/-	12AX7	9/6	ECC85	9/-	HVR2A	5/-	866A	11/6
		12K7GT	6/6						

SEND S.A.E. FOR SPECIAL LIST 500 ITEMS

All items less 5% and post free for a dozen or more.

Postage 1/- in £1 (1/9 in £1 Speakers/Trans.). Min. 6d. No C.O.D.

100 TELEVISION SET BARGAINS TO CALLERS AT:—

350/352, FRATTON ROAD, PORTSMOUTH

We offer a complete Tape Recorder Service

These are some of the other well-known models we stock:

Vortexion 2A	88 gns.
Vortexion 2B	£108.18.0
Brenell Mk. 4	53 gns.
Brenell Deck *with pre-amplifier unit*	38½ gns.
Elon	62 gns.
Grundig TK5	53 gns. inc. mic.
" TK8	72 gns. ex. mic.
" TK820	98 gns. do.
" TK830/3D	100 gns. ex. mic.
Elizabethan	65 gns.
Truvox	66 gns.

★ ★ ★

Tapes *L.P. and Standard*	E.M.I. and BIB splicers
E.M.I.	●
Scotch Boy	Jointing tape and compound
Ferrograph	
Gevaert	●
Mastertape	
Agfa	Wearite
B.A.S.F.	Defluxers

Send stamped addressed envelope for our complete list of Tapes, Accessories and prices.

FERROGRAPH
Model 3A/N

This latest model, with its new capstan, gives even better performance and provides adequately for use of "long-play" Tapes. Single knob control ensures maximum simplicity of operation.

Price 79 gns.

CONTINUOUS DEMONSTRATIONS

Modern Electrics Ltd

Telephones: Temple Bar 7587 Covent Garden 1703

Cables: Modcharex, London

164 CHARING CROSS ROAD, LONDON, W.C.2

HI-FI EQUIPMENT

We stock all the leading makes of amplifiers, control units, transcription units, pickups, loudspeakers and FM Tuner units.

PROMPT ATTENTION GIVEN TO POST ORDERS
EXPORT ENQUIRIES INVITED AND WELCOMED

ME * ME * ME * ME * ME * ME * ME * ME

CHAS. H. YOUNG, LTD.

Don't miss these special offers

CRYSTAL CALIBRATORS
1,000 kc/s crystal controlled, with switched 100 kc/s and 10 kc/s locked multi-vibrators.
This excellent unit is as new and is contained in polished bakelite case with carrying handle. The circuit uses 6 valves and operates from 2 v. l.t. and 120 v. h.t.
PRICE—only £3.10.0 complete with crystal and valves; or with a.c. power unit, £6.10.0

RACK MOUNTING PANELS, all 19in. long by 5¼in., 7in., 8¾in. or 10½in., 5/9, 6/6, 7/6, 9/- respectively. Post 2/-.
ABSORPTION WAVEMETERS. 3 to 35 mc/s. in 3 switched bands complete with indicator bulb 17/6. Post free.
THE NEW GELOSO V.F.O. UNIT. Output on 80/10 metres Complete with calibrated dial, £7/12/6. Set of three tubes, 24/-.
3in. AERIAL INSULATORS. Ribbed glass. 1/6 each or 6 for 7/6. P. & P. 1/6.
CONDENSERS. 8 mfd. 750 v., 5/6 each Post 1/6.
COPPER AERIAL WIRE. 14 g. H/D 140ft. 17/-. 70ft. 8/6. P. & P. 2/-. Stranded 7/25, 140ft. 19/-, 70ft. 5/-. P. & P. 2/-.
AMERICAN OCTAL BASED 1000 kc/s PRECISION CRYSTALS. 30/- each, post free. 100 kc/s, 3-pin, 25/-, post free.
SEMI-MIDGET I.F. TRANSFORMERS (by well-known maker). 10.7 mc/s and 465 kc/s. Can be used as 10.7 mc/s or 465 kc/s singly Only 9/11 pair per postage 9d.
HEADPHONES. High resistance (4,000 ohms), very sensitive. Bargain price, only 12/6 pair. P. & P. 1/6.
BRITISH RESISTANCE MIKES (carbon). Ideal for mobiles. 7/6. P. & P. 2/-.
MULTI-WAY CABLE, ⅛in. diameter. 7 colour coded wires, any length cut. 1/3 per yard. P. & P. min. 1/6.
10-WAY CABLE (5 pairs). Screened and plastic covered 2/- per yard. P. & P. min. 1/6.
LOW RESISTANCE HEADPHONES. New ex-W.D. stock. C.L.R. types Only 8/6 pair. P. & P. 1/6. Special Terms Quantities

Most comprehensive stock of HiFi equipment in the Midlands, including QUAD, LEAK, W.B., RCA, ROGERS, WHARFEDALE, GOODMANS, etc. Details and demonstrations with pleasure.

CHAS. H. YOUNG LTD., 110 DALE END, BIRMINGHAM, 4.
NO C.O.D. UNDER £1 *Phone. CENTRAL 1635*
All Mail Orders to Dept. "W." Please print your name and address.

Estd. **L·R·S** 1925
EASY TERMS

LEAK *QUALITY EQUIPMENT for the Connoisseur*

THE LATEST
"TL/12 PLUS" POWER AMPLIFIER
and the
"VARISLOPE III" PRE-AMPLIFIER

are designed to give the highest possible fidelity from records, radio and tape. As supplied to Broadcasting Stations throughout the world. For the finest quality reproduction together with workmanship of the highest order—your choice must be LEAK.

Cash price of the complete amplifier is **£34/13/-.** We can supply for **9 equal monthly payments of £4/1/-.** Carriage and crate paid.

All other LEAK equipment available on similar terms—also CHAPMAN and LOWTHER TUNERS. GARRARD & CONNOISSEUR Transcription motors, etc. **In fact ALL Quality Equipment supplied over 9 equal monthly payments. 5% Interest charge only.**

We pay all carriage charges.

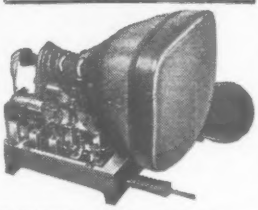
Prompt personal service to your requirements.

The L·R·SUPPLY COMPANY, LTD.
BALCOMBE (Tel. 254) **SUSSEX**

L.

17" T.V. CHASSIS

CASH OR TERMS



Latest improved circuits. Higher E.H.T. (brilliant picture). Improved sensitivity (for greater range). Chassis easily adapted to any cabinet. 17in. rectangular tube on adapted, reconditioned chassis. All channels. 12 months' guarantee on tube, 3 months' guarantee on valves and chassis. Less valves.

£19 . 19 . 6

With 5 valves £21/19/6. With all valves £25/19/6. Valve line-up (5 valves): 6SN7G, 6V6, EY51, 2 6D2s. Others: EL41, EL38, 7-6Ms. Chassis size 11½ × 14½ × 11in. Ins., carr. 25/6 (incl. tube). Turret Tuner 50/- extra. State B.B.C. channels (and I.T.A. if turret tuner required).

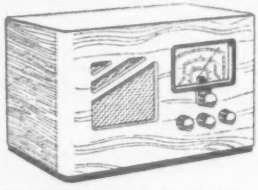
14in. T.V. CHASSIS, TUBE AND SPEAKER £13/19/6. As above with 14in. round tube. Less valves. Guaranteed 3 months. With 5 valves £15/19/6. With all valves £19/19/6 Ins., carr 25/- incl. tube. Turret Tuner 50/- extra.

RECTANGULAR T.V. TUBES

17" £7 . 10 . 0
14" £5 . 10 . 0

12 MONTHS' GUARANTEE

6 months full replacement, 6 months progressive. Made possible by the high quality of our tubes. Ins., carr. 15/6. Special offer of 14in., 15in., 16in. round T.V. tubes £5 Convert your 9in., 10in., 12in. to these larger sizes. Details on how to "Do-it-Yourself" in our FREE catalogue. 12in. T.V. TUBES £6. 3 months' guarantee on all round tubes. 15/6 ins., carr. on all tubes. T.V. TUBES WITH BURNS £1 incl. carriage. Perfect picture. Please enquire for all types and sizes required

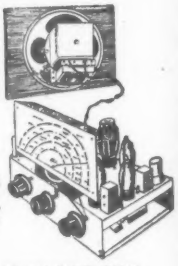


HOME RADIO 79/6

5 valves (octal) superhet. 3 waveband receiver. A.C./D.C. Universal mains can be adapted for gram. P.U. In wooden cabinet. 18½ × 11½ × 8½in. Ins., carr. 7/6.

8in. P.M. Speaker 8/6. Let the lady of the house listen to that radio and T.V programme. Complete with O.P Trans. 10/-. P. & P. 2/8.

DENCO RADIOGRAM CHASSIS 97/6

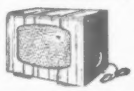


3 and 4 waveband turret tuned. Superhet, A.C./D.C. chassis with 6in. or 8in speaker. Size: 8½ × 10 × 12in. Valve line-up: CCH35, EF39, EBC33, CL33 and CY31 (C1C or dropper). Ins., carr. 7/6.

SUPER CHASSIS 99/6

5-valve superhet A.C. chassis, including an 8in. speaker 4 control knobs (tone, volume, tuning, W.C. switch). 4 waveband with position for gram., P.U. and for extension speaker. Ins., carr. 5/6.

BEAUTIFUL EXTENSION SPEAKER 29/9



Complete, fitted with 8in. P.M. speaker, "W.B." or "Goodmans" of the highest quality. Standard matching to any receiver. 3-5 ohms. Flex and switch included. Unrepeatable at this price. Money refunded if not completely satisfied. Ins., carr. 3/6.

T.V. AERIALS 25/6. For all I.T.A. channels. For outdoor or loft. 3-element at half their original cost. P. & P. 2/6.

Send for FREE 1958 Catalogue **DUKE & CO., (DEPT. 6), 621/3, ROMFORD RD., MANOR PARK, E.12. Tel. ILF. 6001-3.** *Liverpool St.-Manor Park Stn.—10 mins.*

CONDENSERS

ARSS BLOCK CONDENSERS. 3×4 mfd. 500 volts wkg. C96, C97 and C98 new 25/- each. P.P. 2/6.
POWER FACTOR CONDENSERS. 50 + 50 mfd., 300 v., A.C. wkg., 30/- each. P.P. 3/-.
100 MIXED Silvet Micas, 22/6. 100 Mixed Resistors, 15/-.
BLOCK PAPER TYPES. 10 mfd. 440 v. A.C. oil filled, size 6×6×4in., 12/6 each. 8 mfd., 1,200 v. D.C., size 5×4½×3½in., 11/6 each. P.P. 2/6. 8 mfd., 500 v. D.C., size 5×3×1½in., 4/6 each. P.P. 1/6. 6 mfd., 500 v. D.C., size 5×3×2in., 4/- each. P.P. 1/6. 2 mfd., 600 v. D.C., size 2½×2×2in., 3/6 each. P.P. 1/-. 0.5 mfd., 5 kV. wkg., size 7×5×4in., 5/6 each. P.P. 2/-. 0.1 mfd., 5 kV. wkg., size 7×4×2in., 4/6 each. P.P. 1/9. Many other types in stock.
"METALPACK" CONDENSERS 0.5μF, 500 v., 2/-, 0.25μF, 500 v., 1/9. 0.1μF, 500 v., 1/6. 0.1μF, 350 v., 1/-. 0.05μF, 500 v. 0.2μF, 750 v., 0.005μF, 1,000 v., 0.002μF, 1,000 v. and 0.001μF, 570 v., all at 10d. each.
R.F. UNITS type 24B. Brand new in cartons, 18/6 each. P.P. 2/6.
RECEIVER R.C. 624C (part of SCR 522). This well-known receiver covers 100 to 156 Mc. the "C" is the latest type which incorporates several mods. over the earlier models, noise limiter, AVC, squelch circuit and extra audio stage. The power requirements are 300 volts 70 m/a. H.T., 12 volts 3 amp. L.T. New and complete with 11 valves. £2 2/6 each. P.P. 3/6.
SLIDING RESISTORS. 0.4 ohms, 25 amp., 6/- each.
WAFER SWITCHES. 4 p. 2 w., 2/- each; 4 p. 2 w., 1/6 each (with 1in. spindle); 2 p., 4 w., 1/- each; 1 p., 8 w., 1/- each (with ¼in. spindle).
RHEOSTATS W/W. 30 ohms, with S.P. switch ¼in. spindle, 2/- each.
DUAL POTS. 2×1 megs. 1½in. spindle, 2/- each. 500 r. pots with S.P. switch 1½in. spindle, 2/3 each. 50 k., 100 k., 500 k., Pots with 1in. spindle, 10/- per doz.
SPIRIT LEVELS, small for instruments, etc. 1in. long, ¼in wide, 1/- each or 9/- doz.
SLYDLOK FUSE HOLDERS. 5 amp. and 15 amp., 2/- each.
VALVE HOLDERS. Int. Octal (U.S.A. type), 6/- doz. B.7.G. Ceramic with lower skirt, 8/6 doz.
COLVERN W/W pots, 25 k. and 50 k. (preset), 1/6 each, or 15/- doz.
PRECISION RESIST ORS. 2,000 ohms, ±0.5%, 2/- each, or 20/- doz.
BALANCED ARMATURES. (Inserts), 3/- each, or 30/- doz. These are very useful as a small speaker, etc.
STATTMETERS (K.D.G.) 2in. scale 0.150 kilogrammes, £3/10/- each sealed 0.350 kilogrammes, 29/10/- each.
PRESSURE GAUGES (0–100 inches of mercury), 6in. scale. 0.300 mm. h.g. New in cartons, £2 10/- each.
"K" RECEIVERS. This is an infra red receiver complete with P.E. cell CV143 (all purpose) and a Zamboni cell, in a beautiful leather case. New 15/6 each. P.P. 2/-.
KNIFE SWITCHES. 60-amp. change-over, 12/6 each, 2/6 post.
5-AMP. SWITCH SOCKET. flush mounting, 4/6 each. 1/- post.
STUD SELECTOR SWITCH. 20 pos., panel 5×5in., 5/- each. 1/6 post.
RE-ENTRANT SPEAKERS. 10 ohms, 15 watts, new £5 10/- each.
RE-ENTRANT SPEAKERS. 15 ohms, 20 watts. Not new, good as all £4 each

TERMS C.W.O All goods offered are Ex-WD S.A.E. for enquiries

W. MILLS

3-B TRULOCK ROAD, TOTTENHAM, N.17
Phone: Tottenham 9213 & 9330

The Autocar ROAD TESTS 1958

Illustrated reports on the performance of current British, American and Continental cars. Each report contains a description of the car's behaviour under varying conditions; comment on its construction and design; detailed plans showing the controls, instruments and seating arrangements; numerous photographs; and a comprehensive table of technical information.

NOW READY

7s. 6d. net by post 8s. 6d. **from all booksellers**

Published for "The Autocar" by Iliffe & Sons Ltd. Dorset House Stamford Street London S.E.1

Illustrated road test reports on 33 British and foreign cars

Alvis 3-litre
Aston Martin M.111
Austin A.105
Daimler One-O-Four
D.K.W. 3-6 coupe
Dodge Customs Royal
Fiat 500
Fiat 1100
Ford Consul M.11
Ford Zodiac Estate Car
Ford Fairlane 500
Hillman Minx Estate Car
Minx Series I
Minx Series II
Jaguar Mark VIII
Jensen 541R
Lancia 2500
Lloyd LP600
Mercedes-Benz 190SL
M.G. Magnette
Metropolitan
Morris Oxford Series III
Riley One-Point-Five
Standard Super Ten
Standard Eight
Standard Ensign
Sunbeam Rapier
Volkswagen de luxe
Volvo PV444
Wolseley 1500
Wolseley 6/90 Series II

CONVERTORS

Easily the most useful units released by the Ministry. Within minutes you can extend the frequency of any receiver to cover the following:—
R.F.26 50–65 Mc/s Variable tuning **20/-**.
R.F.24 20–30 Mc/s. switched tuning **12/6**.
R.F.25 40–50 Mc/s. switched tuning **8/6**.
R.F.24 Shop soiled, switched tuning **7/6**.
All Brand New with circuit 3/6 postage on each.

RCAF AMPLIFIER UNIT. 12 v. input Vibrator Pack. 250 v. output OZ4. Microphone transformer into a 6K6 GT output valve with negative feed back, size 8 × 5½ × 8½in. Brand new, **30/-** each. P. & P 3/-.

WAVEMETER TYPE WI433. Frequency 154–260 mc/s., with crystal check and calibration chart. Mains 50 cycle. **50/-**, carriage 10/-

COMMUNICATION RECEIVER RA 1B. Covers 150 kc/s.-15 mc/s. in 6 bands. 12 or 24 operation. S.A.E. for details.

PARMEKO CHOKES. 8 H. 100 mA. **7/6**. P. & P. 1/6.

LUMINOUS MAGNETIC MARCHING COMPASS. Pocket size Brand new with instructions. ONLY **12/6**. P. & P. 1/-

WIRELESS SET NO. 19 MK. II Two transmitter-receivers and an intercom. amplifier in one case. "A" set covers 2—8 mc/s., RT and CW and "B" set 240 mc/s., RT only. Complete with 15 valves and 500 Micro amp. check and Tuning Meter. Complete with circuit and instruction booklet. Only **60/-**, plus 10/- carr.

MUIRHEAD VERNIER SLOW MOTION DRIVES. Scaled 0-180 deg. Ratio 25 to 1. 3in. dia. **10/6** p.p. 1/6.
WESTON 1 AMP. H.F. METERS 2in. circular Brand new, **5/6**. P. & P. 1/-.

DIPOLE AERIAL No. 4A. 52 feet hard drawn 7/22 copper wire with centre insulator, fitted with feeder sockets. Both ends have 3 link insulators and slotted wire adaptors. Brand new, price **9/-**. P. & P. 2/-.

500 MICROAMPS METER. 2in. circular calibrated 0–15 and 0-600 volts, resistance 500 ohms. **12/6**. P. & P. 2/6.

BENDIX RECEIVER MN26.C. Covering 150-1,500 kc/s. in 3 bands. Valves used 5-6K7, 2-6N7, 2-6J5, 1-6F6, 1-6L7. Complete with switching motor and dynamotor. This superb unit has been modified for 12 v. operation Ideal car radio. With circuit. Only **80/-**, carr. 8/6.

RELAYS. 6,500 ohms and 3,500 ohms. 8/- pair, post paid.

DYNAMIC SOUND POWERED HEADPHONES. Type D.L.R. 5. 60. ohms. **7/6**. P. & P. 1/6.

HIGH RESISTANCE HEADPHONES. Type No 2 4,000 ohms. Brand new **11/6** each. P. & P. 1/6.

INDICATOR UNIT SLC No. 5. Ideal for conversion into an Oscilloscope using a 139A or ACR 10 tube. Unit consists of 2-VR65's, 1-VR66, various resistors, condensers and pots. Size 11 × 6 × 3in. Brand new, complete with modification circuit. **20/-**. P. & P. 3/-.

COMMUNICATION RECEIVER R1155

This magnificent receiver covers 5 ranges: 75–200 kc/s., 200–500 kc/s., 600–1,500 kc/s., 3–7.5 mc/s., 7.5–18.5 mc/s. Fully tested before despatch. Complete with N. Type drive circuit and instruction booklet, **£3/10/-**, carriage 10/-.

WALKIE/TALKIE SET

Transmit and receive on 7.4-9 mc/s, range approx. 5 miles. Set consists of Transreceiver complete with 5 valves, 6 foot aerial microphone, headset and junction box. Works off 150 v H.T and 3 v. L.T Complete set sent for only **65/-**. P. & P. 4/-.

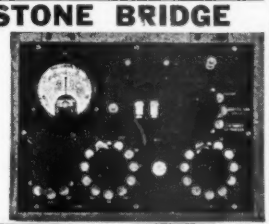
SATELLITE RECEIVER

Receive Radio Signals being transmitted by the U.S. Satellite on approx. 108 Mc. This Receiver is AM and Crystal Control on six pre-set frequencies in the 108.3 to 110.3 MC range. Provides audio and band pass filter output of 90 and 150 cycles for aircraft instrument landing, for which it was originally used. Complete with ten valves: 1/12AH7, 2/12SG7, 2/12SR7, 1/12SQ7, 3/717, 1/12A6. Crystals. Voltage required: 12 or 24 VDC and 220 VDC 80 MA. Size: 13¾in. × 5in. × 7in. Also can be converted to FM Receiver 80 to 108 Mc. Price £4, carriage 7/6.

WHEATSTONE BRIDGE

Consisting of four stud switches: 0–10 ohms, 0–100 ohms 0-INF. Galvanometer centre zero F.S.D. 2.5mA. Kanges easily extended. Housed in oak cabinet 15 × 7½ × 6in. Complete with instructions, **40/-**.

P. & P. 4/-.

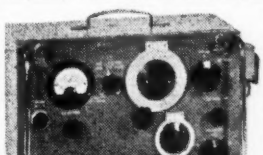


BENDIX RECEIVER RA 10

A 4 wave-band superhet covering 150 kc/s.–10 mc/s. Valves 6SK7 1st R.F. 6K8 Mixer. 6SK7 1st and 2nd I.F. 6R7 2nd Det. 6C5 B F.O. 6K6 output. Size 6½in. × 15¼in. Easily converted to mains operation as described on page 453 of the September "Practical Wireless." **£5/10**. carr. 7/6.

SIGNAL GENERATOR TYPE 52A

Frequency 6–52 Mc/s. in four ranges. Internal mains pack, extensively filtered. 50μ amp. R.F. Meter. Internal or external modulation. Calibrated coarse and fine (in μV) attenuator output impedance 70 or 100 ohms minimum output 0.5μ volts, maximum output 100 mV. Complete with all leads calibration charts and circuit. Brand New in original manufacturer's cases **£8/10/-**, carr. 10/-.



VALVE LIST

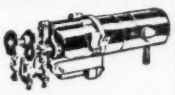
2X2	2/6	616	5/-	9004	1/9	P61	3/6
5U4G	7/6	6K7	5/-	9006	3/6	SP61	3/-
6AC7	5/-	6SH7	6/-	12A6	6/6	VR116	3/-
6AG7	9/6	6SL7GT	7/-	12J5	6/-	VR15030	6/-
6AK5	6/6	6SN7GT	6/6	12SH7	5/-	VT501	3/-
6C4	3/6	6V6GT	7/6	EA50	1/6	446B	25/-
6H6	2/6	955	1/9	EB34	1/6	464A	25/-
6J5	4/6	956	1/9	EF50	3/-		

All brand new and tested. Please add postage and packing.

Relda Radio Ltd.

(Dept. "W,") 32A, Coptic Street, London, W.C.1.
Phone: MUSeum 9607
Tottenham Court Road Underground Fourth turning on left down New Oxford Street.

AMERICAN GEARED MOTOR. 24 v. D.C. with built-in precision gearbox. No. 1 drive 24 R.P.M. No. 2 drive 6 R.P.M. On 12 v. No. 1 drive 16 R.P.M. No. 2 drive 4 R.P.M. Overall size of motor and gearbox 7½ × 3½ x 3in., weight 11b. 14 oz. Brand new. **17/6**. P. & P. 3/-.



RCA MAINS TRANSFORMERS. Input 110-240 v. Output 245-0-345 at 150 mA. 6.4 v. at 4.5 amps., and 5 v. at 2 amps. Brand new, fully shrouded. Write now. Only **35/-**. P. & P. 3/-.

LEAD ACID ACCUMULATORS (Unspillable). 2 volts 16 A.H. Ideal for 6 volts and 12 volts supply. Brand new original cartons. Size 4in. × 7in. × 2in., **5/6** each. P.P. 2/6; 3 for **15/-**, P.P. 3/6; 6 for **27/6**; P.P. 5/-.

PUSH BUTTON COIL PACKS. 465 Kc/s. I.F. Gram. Long, Medium and 6 Shortwaves, **8/6**, post 1/6.

0-25 AMPS. 2½in. ROUND FLUSH MOUNTING METERS. New and boxed, **8/6**. Post 1/6.

SIGNAL GENERATOR AND WAVEMETER. Type W.1649. Frequency of Signal generator: 140 to 240 Mc/s. Accuracy +0.5 Mc/s. Frequency of Heterodyne Wavemeter: 155-255 Mc/s. Accuray + 0.2 Mc/s. Containing VR 135 and 4VR91, 5 meg. crystal. Retractable aerial. Power requirements: 6.3 volts and 120 volts. Unit housed in copper lined wooden case. Size 15½in. × 13in. × 14½in., **45/-**, plus 10/- carr

FERRANTI TRANSFORMERS. Onput 225 volts output 4 volts at 2 amps. or .5 amps Potted type with ceramic bushes. Brand new, **7/6** each. P. & P. 1/-.

VIBRATOR PACK. 12 VOLT input 300 volts output at 150 mA. As a bridge rectifier will handle 450 volts RMS at 120 mA. Pack consists o. 12 volt vibrator, 4 metal rectifiers, chokes and smoothing condensers. ONLY **30/-**. carriage 5/-.

TANNOY AMPLIFIER. With 4 6L6's in parallel, push-pullhandling from 30 to 60 watts 200-250 v. input. Complete with all leads, hand microphones, plugs and spares. Housed in wooden transit case 17½ × 15½ × 21½in With full operating instructions and circuit Fully tested. ONLY **£20**. Speakers for above **25/-** each.

AMERICAN MIDGET ACCUMULATORS. 36 volts, lead acid type. **2/6** each. P. & P. 1/-.

AMERICAN ROTARY CONVERTORS. With cooling Fan. Input 12 v. D.C. Output 250 v. at 90 mA. Completely suppressed. Brand new, **19/-** each, plus P. & P. 3/-.

COLVERN WIRE WOUND POTENTIOMETERS. 25 watts 50k and 100k. Price **6/-** each.

HEADPHONE & MICROPHONE ASSEMBLY. Consisting of padded headphones and No. 7 moving coil hand microphone with cord and plug. Brand new Price **10/-**.

PYE 45 mc/s. I.F. STRIPS. Complete with seven valves, 6-EF50, 1-VR92, 6 tunable I.F. transformers. Only **30/-**, post paid.

COMMAND RECEIVERS. 1.5-3 Mc/s., fully valved, with circuit, **65/-**. P. & P. 3/6.

LOOP ASSEMBLY CRV. 69065. Suitable for use with communication Receivers with aural D/F. Loop is manual operation and fitted with calibrated scale and 28 inch drive extension. Weight 15 lbs. Height 4 feet. R.C.A. Manufacture and brand new in original cartons **£6/10/-**, carriage 20/-.

BRADMATIC

HIGH QUALITY TAPE RECORDING EQUIPMENT

OUR RANGE OF TAPE DESKS

Model 5D	(Taking up to 10½in. reels)	£50. 0. 0
Model 5CL	" " " 9½in. "	£47. 10. 0
Model 5CS	" " " 9½in. "	£45. 10. 0
Model 5B	" " " 7in. "	£42. 0. 0

All with two speeds, 3¾ and 7½ i.p.s. Three half track heads. Three heavy duty motors.
Desks also available fitted with stereophonic heads suitable for playing back E.M.I. "Stereosonic" tapes.

OUR RANGE OF MAGNETIC HEADS

HALF TRACK

Standard (.970in. dia.)
Type 6RP Super Rec/Play
Type 5RP Rec/Play
Type 5R Record
Type T5E Erase

Miniature (15 mm. dia.)
Type M6RP Super Rec/Play
Type M5R Record
Type M5E Erase

FULL TRACK (.970 dia.)
Type 6RPF Super Rec/Play
Type 5RPF Rec/Play
Type 5RF Record
Type 5EF Erase

All the above heads are high impedance but low impedance heads can be wound at extra cost.
Two types of fixing stem available. Screening Cans available.

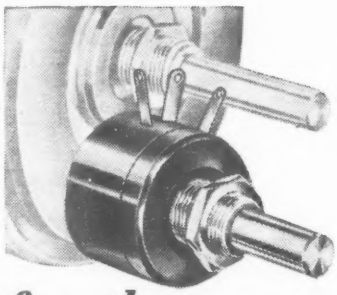
AMPLIFIERS

Our type 10 Record/play amplifiers have an overall frequency response of 30—15,000 cycles within 4 db. unweighted. Details on application.

Send for lists. Private and Trade supplied.

BRADMATIC LIMITED

STATION ROAD ASTON BIRMINGHAM, 7
Phone: EAST 2881-2 *Grams: Bradmatic, Birmingham*



The Reliance standard range of Potentiometers includes linear, log, semi-log, and non-inductive types, and depending upon characteristic, ratings up to 20 watts.

from the famous range of **RELIANCE**

POTENTIOMETERS

The Type MW miniature is a worthy addition to the world-famous Reliance range. It is essentially a "quality" unit for use in all electronic equipment where space considerations are vital—the illustration is actual size.

LINEAR LAW—5-50,000 ohms : 1 watt.
MAX. WORKING VOLTS—500 d.c.

Full technical details in Data Sheet No. 1.

RELIANCE MANUFACTURING CO. (Southwark) LTD.
Sutherland Road, Higham Hill, Walthamstow, E.17.
Phone : LARkswood 3245

NEW 1958

RADIO AMATEUR'S HANDBOOK

32/6 by A.R.R.L. Postage 1/9.

FREQUENCY MODULATION by A. W. Keen, 30/-. Postage 9d.

ELEMENTS OF TAPE RECORDER CIRCUITS by H. Burstein and H. C. Pollak, 23/-. Postage 9d.

RAPID TV REPAIR by G. W. Heath, 23/-. Postage 9d.

QUALITY AMPLIFIERS for A.C. Mains. Data Publication 4/6. Postage 4d.

AN INTRODUCTION TO THE CATHODE RAY OSCILLOSCOPE by H. Carter, 12/6. Postage 6d.

TELECOMMUNICATIONS by W. Fraser, 65/-. Postage 1/6.

ELECTRONIC DESIGNERS' HANDBOOK by R. W. Landee, D. C. Davis and A. P. Albrecht, 128/-. Postage free.

IMPROVE YOUR RECEPTION by J. Cura and L. Stanley. 5/-. Postage 4d.

RADIO VALVE DATA. Compiled by "W.W" 5/-. Postage 8d.

THE MODERN BOOK CO.
19-23, PRAED STREET, LONDON, W.2

BRITAIN'S LARGEST STOCKISTS OF BRITISH AND AMERICAN TECHNICAL BOOKS

Complete Catalogue 6d.

PADdington 4185. Open 6 days 9-6 p.m.

WIRELESS BARGAINS

TRANSRECEIVERS. Type "38" (Walkie Talkie) complete with 5 valves, etc. New condition untested by us but serviceable, no guarantee. 22/6 each.

ATTACHMENTS for Type "38" Transreceivers. ALL BRAND NEW: Headphones 15/6; Throat Microphones 4/6; Junction Boxes 2/6; Aerials, No. 1 2/6; No. 2, 5/-; Webbing 4/-; Haversacks 5/-; Valves—A.R.P. 12 4/6; A.T.P.4, 3/6; Set of FIVE VALVES 19/- the set.

TRANSRECEIVERS. Type "18" Mark III. Two Units (Receiver and Sender). Six Valves, Microammeter etc. in Metal Case. Untested, without guarantee but COMPLETE £2/18/6.

ATTACHMENTS for "18" Transreceivers. ALL BRAND NEW. Headphones 15/6; Hand Microphone 12/6; Aerials 5/-; Set of 6 Valves 30/-.

RECEIVERS R.109, S.W. Receiver in Case, eight valves. Speaker and 6-v. vib. Pack. Untested, no guarantee but COMPLETE £2/18/6.

RESISTANCES. 100 Assorted useful values. New wire end 12/6.

CONDENSERS. 100Ad. Mica; Tubular; etc. 15/-.

BOMBSIGHT COMPUTERS. Ex-R.A.F. NEW. Hundreds of Components, Gears, etc. £3.

LUFBRA HOLE CUTTERS. Adjustable ⅞in. to 3½ in. For Metal, Plastic, etc. 7/-.

QUARTZ CRYSTALS. Types F.T.241 and F.T.243. 2-Pin. ½in. Spacing. Frequencies between 5,675 Kcs. and 8,650 Kcs. (F.T.243). 20Mcs. and 38.8 Mcs. (F.T.241. 54th Harmonic) 4/- each. ALL BRAND NEW. TWELVE ASSORTED CRYSTALS 45/-. Holders for both types 1/- each. Customers ordering 12 crystals can be supplied with lists of Frequencies available for their choice.

MORSE TAPPERS. Standard type 3/6; Extra Heavy on Base 5/6.

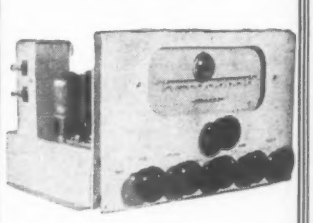
TRANSPARENT MAP CASES. Plastic 14in. x 10in. Ideal for Maps, Display, etc. 5/6.

STAR IDENTIFIERS. Type I A-N Covers both Hemispheres 5/6.

Post or carr. extra. Full list Radio Books etc., 3d.

SOUTHERN RADIO SUPPLY LTD
11 LITTLE NEWPORT STREET,
LONDON, W.C.2. GERrard 6653

Fidelia



Fidelia hand built high quality equipment includes the following models :—

Fidelia Imperial. V.H.F. reception, plus gramophone pre-amplifier for all types of pick-ups, recording equaliser, full tone control circuit, tape jacks etc. Price with our Major amplifier **£38.** As a self powered VHF tuner and Pre-amp control unit **£20.**

Fidelia Major. Short, Medium and Long Wavebands plus VHF/FM, gram. pre-amp and full tone control. High sensitivity, R.F. stage on all bands, variable selectivity. Cathode ray tuning indicator. Price with our Major amplifier **£44.**

Fidelia De-Luxe. 11 valve chassis. VHF/FM plus Medium and Long wavebands, full tone control, 7 watt push-pull output stage. **£34/10/-.**

Fidelia Pre-Amplifier control unit. A new unit with a versatile recording equaliser circuit. Inputs also for radio and tape replay. Complete with our Major amplifier **£30.**

Full details willingly on request (6d. in stamps is appreciated).

ELECTRO Acoustic DEVELOPMENTS

2 AMHURST ROAD, TELSCOMBE CLIFFS Nr. Brighton, SUSSEX
Tel. Peacehaven 3186

C.R.T. ISOLATION TRANSFORMERS

For Cathode Ray Tubes having Heater/Cathode short circuit and for C.R. Tubes with falling emission.
Type A. Low leakage windings. Ratio 1 : 1.25 giving 25% boost on Secondary.

2 volt	10/6 each
4 volt	10/6 each with Tag
6.3 volt	10/6 each Panel and
10.8 volt	10/6 each Solder Tags
13.3 volt	10/6 each
Ditto with mains primaries	12/6 each

Type B. Mains input 220/240 volts. Low Capacity. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for all Cathode Ray Tubes. With Tar Panel 21/- each. Ditto for 6 volt Tubes only 17/6.
Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2½-2½-3 volts at 2 amps. 17/6 each.
All Isolation Transformers are individually boxed, labelled and clearly marked with rating and data.
NOTE:—It is essential to use mains primary types with T.V. recievers having series connected heaters.

RESISTORS. All preferred values. 20% 10 ohms to 10 meg. ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-. HIGH STABILITY. ½ w., 1%, 2/-. All preferred values 100 ohms to 10 meg. Ditto 5%, 9d., 10%, 6d.

5 watt, 10 watt, 15 watt	WIRE-WOUND RESISTORS 25 ohms—10,000 ohms — 1/3, 1/6, 2/-
15,000 ohms—50,000 ohms 5 w., 1/9; 10 w.	2/3

WIRE-WOUND POTS. 3 WATT LAB. COLVERN, ETC.

Pre-set Min. T.V. Type Knurled Slotted Knob. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. Ditto Carbon Track 50 K. to 2 Meg., 3/-.	Standard size Pots., 2½in. Spindle High Grade. All Values, 100 ohms to 50 K., 5/6; 100 K., 6/6. W/W EXT. SPEAKER CONTROL 10Ω., 3/-.

O/P TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multi-ratio push-pull, 7/6. Miniature 3V4, etc., 4/6. Hyxrade Push-pull 7 watts, 15/6.
L.F. CHOKES 15/10 H. 60/65 mA., 5/-; 25/20 H. 100/120 mA., 11/6; 20/15 H., 120/150 mA., 12/6; H. 250 mA., 15/-.
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v., 4 a. 5 v. tapped 4 v. 2 a., ditto 250-0-250 80 mA., etc., 22/6. Bargain 300-0-300 v. 65 mA., 6 v. 4 a., 4 v. 2 a., 15/-.

I.F. TRANSFORMERS 7/6 pair

465 kc/s slug tuning miniature can 2½ × 1 × 1in. High Q and good band width. By Pye Radio. Data sheet supplied. Wearite M800 I.F. transformers 465 kc/s. 12/6 pair. Wearite 550 I.F. transformers 465 kc/s. 12/6 pair.

HEATER TRANS. Tapped 200/250 v. 6.3 v. 1½ amp., 7/6.
ALADDIN FORMERS and cores. ½in., 8d.; ¾in., 10d. ⅝in. FORMERS 5637/8 and Cans TV1 2. ½in. sq. × 2½in. and ⅝in. sq. × 1¼in., 2/- complete with cores.
SLOW MOTION DRIVES. Epicyclic ratio 6 : 1, 2/3.
TYANA. Midget Soldering Iron. 200/220 v. or 230/250 v., 16/9.
SOLON INSTRUMENT IRON. 25 w., 24/-.
MAINS DROPPERS. 3 × 1½in. Three Adj. Sliders, 3 amp. 750 ohms, 4/3. .2 amp., 1,000 ohms, 4/3.
LINE CORD. .3 amp., 60 ohms, per foot, .2 amp., 100 ohms per foot, 2 way, 6d. per foot, 3 way, 7½ per foot.

CRYSTAL MIKE INSERT by Acos

Precision engineered. Size only 1¼ × 3/16in. Bargain. Price 5/6. No transformer required.

MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Pottel, 10/6.
LOUDSPEAKERS P.M. 3 OHM. 2½in. square, 17/6. 5in. R.A., 17/6. 7in. × 4in. Goodmans 21/-. 5½in. Square Elac., 21/-. 8in. Plessey, 19/6. 6½in. Goodmans, 18/6. 10in. R.A., 30/-. 6in. ELAC TWEETER, 25/-. 12in. Plessey, 30/-. 8in. M.E. 2.5 k. field tapped O.P. transformer, 24/6. 15 ohm Plessey 10 wt. 12in. with Tweeter, 97/6.
CRYSTAL DIODE G.E.C. 2/-. GEX34, 4/-. 40 Circuits, 3/-.

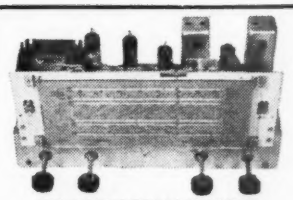
TELETRON CRYSTAL SET

Complete kit with cabinet 4½ × 3 × 1½in. All components and instructions. 15/- or 30/- with pair of lightweight H.R. headphones to match.

H.R. HEADPHONES. 4,000 ohms, brand new. 16/6 pair.
SWITCH CLEANER Fluid, squirt spout, 4/3 tin.
TWIN GANG CONDENSERS. 365 p.f. Miniature, 1⅛in. × 1½in. × 1¼in., 10/-. .0005 Standard with trimmers, 9/-; less trimmers, 8/-. Midget, 7/6; Single 50 p.f., 2/6.
Solid Dielectric 100, 300, 500 pf., 3/6 each.
VALVE HOLDERS. Pax int. Oct., 4d. EF50, EA50, 6d.
RIZA, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin, 1/-.
MOULDED Mazda and Int. Oct., 6d., B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. VCR97, 2/6. B9A with can, 2/6.
CERAMIC, EF50, B7G, B9A Oct., 1/-. B7G with can, 1/9.
SPEAKER FRET. Gold Cloth 17in. × 23in., 5/-. 25in. × 30in., 10/-. Expanded metal, silver 15½in. × 9½in., 2/-.
Tyrzan 4ft. 6in. wide, 10/- ft.; 2ft. 3in. wide, 5/- ft.
WAVECHANGE SWITCHES.
2 p. 2-way 3 p. 2-way, short spindle..... 2/6
6 p. 4-way 2 wafer, long spindle..... 6/6
3 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle..... 3/6
3 p. 4-way, 1 p., 12-way, long spindle..... 3/6
Wave change "MAKITS." 1 wafer 8/6; 2 wafer 12/6; 3 wafer 16/-; 4 wafer 19/6; 5 wafer 23/-; 6 wafer 26/6.
TOGGLE SWITCHES. S.P., 2/-; D.P. 3/6; D.P.D.T., 4/-.
MORSE KEYS, good quality 2/6. Buzzers 3/6.

MULLARD "3—3" AMPLIFIER

A really first-class 3-valve 3-watt Amplifier giving Hi-Fi quality. Valve line-up: EF86, EL84, EZ80. H/duty mains trans. giving extra HT and LT for Tuner Unit addition. Variable treble cut and bass boost controls, 3-watt output. Complete amplifier wired and tested with output transformer to Mullard specification. £7.17.6. Carr. and ins. 2/6.



1958 RADIOGRAM CHASSIS

THREE WAVEBANDS FIVE VALVES
S.W. 16 m.—50 m. LATEST MULLARD
M.W. 200 m.—550 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40
12 month Guarantee. A.C. 200/250 v., 4-way switch. Short-Medium-Long-Gram. A.V.C. and Negative feedback. 4.2 watts. Chassis 13½in. × 5¼in. × 2¼in. Glass Dial 10 × 4¼in. horizontal or vertical available. 2 Pilot Lamps. Four Knobs, Walnut or Ivory, aligned and calibrated. Chassis isolated from mains.

BRAND NEW £10.10.0 Carr. 4/6.

TERMS: Deposit £5/5/- and 6 monthly payments of £1. MATCHED SPEAKERS FOR ABOVE CHASSIS: 8in., 17/6; 10in., 25/-; 12in., 30/-.

★ COLLARO ★

HIGH FIDELITY AUTOCHANGER

MODEL RC456

For 7", 10", 12" Records 16, 33, 45, 78 r.p.m.

4-SPEEDS—10 RECORDS WITH STUDIO "O" PICK-UP

BRAND NEW IN MAKER'S BOXES

OUR PRICE £9.15.0 Post free.

TERMS: Deposit £5/5/- and 6 monthly payments of £1
SUITABLE PLAYER CABINETS 49/6
AMPLIFIER PLAYER CABINETS 63/-

IMPORTANT NOTICE

THESE RECORD PLAYERS AND AUTO-CHANGERS ARE GUARANTEED FOR TWELVE MONTHS AND SPARES ARE AVAILABLE.

GARRARD 4-SPEED SINGLE RECORD PLAYER 4SP

Brand new and fully guaranteed 12 months

AUDIO PERFECTION

Designed to play 16, 33, 45, 78 r.p.m. Records, 7in., 10in., 12in. Lightweight Xtal pick-up, GC2 turnover head, two separate sapphire styli, for Standard and L.P., each plays 2,000 records. Voltage 200/250 A.C.

OUR PRICE £8.0.0 each. Post Free. Terms: Deposit £5 and 4 monthly payments of £1. Space required 14in. x 12in. 3in. above and 2½in. below.

Amplifier Player Cabinets, 45/-.

BUILD THIS REPRODUCER BARGAIN SPECIAL SINGLE PLAYER KIT

FAMOUS MAKER'S SURPLUS STOCKS

4-speed Collaro "Junior" Unit...	£4 12 6
Handsome portable case, 17½ x 13½ x 7in.	£2 5 0
Ready-built 3 watt amplifier with two valves and loudspeaker.....	£3 12 6

All available separately. Post 2/6 each.

or **£9.15.0** complete kit post free.

COSSOR COMPANION

SUPERHET MODEL 527/X FOR ALL-DRY BATTERY OPERATION

S.W.1 13.6 to 43 metres, S.W.2. 42.8 to 136 metres, Medium 187 to 575 metres

A fine all-wave receiver giving world-wide reception on three wavebands. Operation is from a single dry battery, very economical low consumption valves 1AC6, 1AJ4, 1AH5, 3C4.

6in. ELLIPTICAL LOUDSPEAKER

The cabinet is attractively presented in maroon and beige with gold trimmings.

SIZE 9½ x 6½ x 4½in. Leaflet S.A.E.

OUR PRICE £6.15.0 (Battery 19/6 extra)

Carriage and insurance 4/6

THE HI-GAIN BAND 3 PRE-AMP

Cascode circuit using Valve ECC84. Complete kit 27/6 less power; or 49/6 with power pack kit.

Volume Controls

Midget size
Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg. No. Sw. S.P.Sw. D.P.Sw.
3/- 4/- 4/9
Linear or Log Tracks

80 ohm CABLE Coaxial

Semi-air spaced Polythene insulated ⅛in. dia. Stranded core. Ideal Band III. 9d. yd. Losses cut 50%.

FRINGE QUALITY
AIRSPACED.... 1/6 yd.

COAXIAL PLUGS	1/-	DOUBLE SOCKET	1/3
SOCKETS	1/-	OUTLET BOXES	4/6

BALANCED TWIN FEEDER per yd. 6d. 80Ω or 300Ω.
TWIN SCREENED BALANCED FEEDER 1/- yd., 80 ohms.
TRIMMERS, Ceramic, 30, 50, 70 pf., 9d. 100 pf. 150 pf. 1/3. 250 pf., 1/6. 600 pf., 750 pf., 1/9. Phillips, 1/- ea.

ALUMINIUM CHASSIS. 16 s.w.g. Plan, undrilled, with 4 sides, riveted corners and lattice fixing holes, with 2½in. sides. 7 × 4in., 4/6; 9 × 7in., 5/9; 11 × 7in., 6/9; 13 × 9in., 8/6; 14 × 11in., 10/6; 15 × 14in., 12/6; and 18 × 16 × 3in., 16/6.

BLACK CRACKLE PAINT. Air drying, 3/- tin.
P.V.C. CONN. WIRE, 10 colours, single or stranded, 2d. yd.
NEON MAINS TESTER SCREWDRIVERS, 5/-.
MULTICORE SOLDER 60/40, 18 s.w.g., 3d.; 16 s.w.g., 4d. yd.

12/6 PURETONE RECORDING TAPE

1,200 ft. on standard fitting 7in. metal reels. Spare Reels 5½in. plastic, 3/-; 7in. plastic, 4/-.

SUPERIOR 1,200ft. Plastic Tape 21/- on 7in. plastic reels.

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK. VOLTAGES. K3/25 2 kV., 5/-; K3/40 3.2 kV., 7/-; K3/45 3.6 kV., 7/6; K3/50 v. 4 kV., 8/-; K3/100 8 kV., 14/6. 50 c.p.s. Voltage 30% of above.
MAINS TYPE. RM1, 125 v., 60 mA., 5/-; RM2, 100 mA., 6/-; RM3, 120 mA., 8/-; RM4, 250 v. 275 mA., 16/-.
MINIATURE CONTACT COOLED RECTIFIERS. 250 v. 50 m/a., 8/6; 250 v. 85 m/a., 9/6.
COILS. Wearite "P" type, 3/- each. Osmor Midget "Q" type adj. dust core, from 4/- each. All ranges.
TELETRON. L. and Med. T.R.F., with reaction, 3/6.
FERRITE ROD AERIALS. M.W., 8/9; M. and L., 12/6.
T.R.F. COILS A/HF, 7/- pair. H.F. CHOKES, 2/6.

JASON F.M. TUNER COIL SET, 25/-. H.F. coil, aerial coil, Oscillator coil, two I.F. Transformers 10.7 Mc/s., Detector transformer and heater choke. Circuit and component book costing four 6AM6, 2/-. J.B. Chassis and Dial, 19/6. Complete Kit, £5/18/6. With Jason superior calibrated dial, £6/15/-. Mercury Complete Kit, £9/19/6.

CONDENSERS. New stock. .001 mfd. 7 kV. T.C.C., 5/6. Ditto 20 kV., 9/6; 100 pf. to 500 pf. Mica, 6d.; Tubular 500 v. .001 to .01 mfd., 9d.; .05 .1, 1/-; .25, 1/6; .5, 1/9; .1 350 v., 9d.; 0.1 mfd. 2,000 v., 3/6; 0.01 mfd. 2,000 v. 1/9.
CERAMIC CONDS. 500 v. .3 pf. to .01 mfd., 10d.
SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. CLOSE TOLERANCE (± 1 pf.) 1.5 pf. to 47 pf., 1/6. DITTO 1% 50 pf. to 815 pf. 1/9; 1,000 pf. to 5,000 pf., 2/-.

NEW ELECTROLYTICS. FAMOUS MAKES.

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	3/-	8+16/450 v.	5/-
2/450 v.	2/3	8+8/500 v.	4/6	16+16/450 v.	5/6
4/450 v.	2/-	16+16/500v.	6/-	6,000 mfd. 6 v.	6/6
8/450 v.	2/3	CAN TYPES		32+32/350 v.	4/6
8/500 v.	2/9	Clips	3d.	32+32/450 v.	6/6
16/450 v.	3/6	16/450 v.	3/6	64+120/275 v.	7/6
16/500 v.	4/-	32/350 v.	4/-	60+100/350 v.	11/6
32/450 v.	5/6	64/330 v.	5/6	100+200/275 v.	12/6
25/25 v.	1/9	100/275 v.	5/6	1,000+1,000/6 v.	6/6
50/25 v.	1/9	50+50/350 v.	7/-		
50/50 v.	2/-	500/12 v.	3/-		

FULL WAVE BRIDGE SELENIUM RECTIFIERS. 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6.
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v. 1½ a., 15/6; 2 a. 17/6; 4 a., 22/6.

VALVES

All boxed. New & Guaranteed

1R5	8/6	6K8	8/6	EABS0	8/6
185	8/6	6L6	10/6	EB91	6/6
1T4	8/6	6Q7	10/6	EBC33	8/6
3S4	8/6	6SA7	7/6	EBC41	10/6
3V4	8/6	6SN7	8/6	EBF80	8/6
5U4	8/6	6V6G	7/6	ECC84	12/6
5Y3	8/6	6V6GT	8/6	ECF80	10/6
5Z4	10/6	6X4	7/6	ECF82	10/6
6AM6	8/6	6X5	7/6	ECH42	10/6
6B8	5/6	7S7	8/6	ECL82	12/6
6BE6	7/6	12A6	7/6	ECL82	12/6
6BH6	10/6	12AH8	10/6	EF39	7/6
6BW6	8/6	12AT7	10/6	EF41	10/6
6BW7	8/6	12AU7	10/6	EF50	5/6
6CH6	10/6	12AX7	10/6	Equip.	
6D6	7/6	12BE6	10/6	EF50	8/6
6F6	7/6	12BH7	10/6	Sylv.	
6H6	3/6	12K7	8/6	EF80	10/6
6J5	6/6	12Q7	8/6	EF92	5/6
6J6	7/6	35Z4	10/6	EL32	5/6
6J7	8/6	80	8/6	EL84	10/6
6K6	6/6	954	1/6	EY51	12/6
6K7	5/6	EA50	1/6	EZ40	10/6
				EZ81	11/6
				E1148	1/6
				HABC80	12/6
				HVR2A	7/6
				MU14	10/6
				P61	6/6
				PCC84	12/6
				PCF80	10/6
				PCF82	10/6
				PCL82	10/6
				PEN25	6/6
				PL82	10/6
				PY80	10/6
				PY81	10/6
				PY82	10/6
			8/6	SP61	6/6
				UBC41	10/6
				UCH42	10/6
				UF41	10/6
				UL41	10/6
				UY41	10/6
				U22	10/6
				X79	10/6

NEW AND ENLARGED SHOWROOMS NOW OPEN

Our written guarantee with every purchase. Please address all Mail Orders correctly as below

RADIO COMPONENT SPECIALISTS

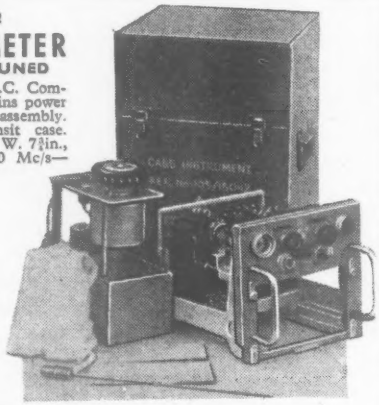
337 WHITEHORSE RD., WEST CROYDON

OPEN ALL DAY—(Wed. 1 p.m.) CATALOGUE 6d

TEL. THO 1665. Buses 133 or 68 pass door. S.R. Stn. Selhurst. 48-hour postal Service. P. & P. 1/-, £2 orders post free (Export extra). C.O.D. Service 1/6

Precision
WAVEMETER
CAVITY TUNED

110-230 v. A.C. Complete with mains power lead, aerial assembly. New in transit case. Size: D. 9in., W. 7¼in., L. 8¼in. 440 Mc/s—466 Mc/s.



£2.15.0
P. & P. 5/-

LOUDSPEAKERS

18" L. × 18" W. × 8" deep cabinet. 8in. Speaker with Transformer in good condition. **£1.0.0** P. & P. 5/-

17" L. × 17" W. × 8" deep cabinet. 10in. loudspeaker. **£1.5.0** P. & P. 5/-

POWER FACTOR CONDENSERS

160μF 290 V.r.m.s. 50 cycles. Fitted with discharge resistance. In manufacturer's cases.

£2 P. & P. 5/-

A. PRESTON & SONS
186 Sussex Way, London, N.19 Phone: ARChway 5951

WAFER SWITCHES TO SPECIFICATION

As we specialise *only* in the manufacture of small quantities of wafer switches (to individual specification) we guarantee competitive prices and fast delivery.

SWITCHES TO PUBLISHED DESIGNS (FROM STOCK)

G.E.C. 912-PLUS

S1 (14061/B1) } 14/6 pair
S2 (14062/B1) }

S4 (SS/556/1) ... 11/6

S5 (SS/556/2) ... 10/6

Mullard Tape Amplifiers

Amplifier "A"
SS/567/A, SS/567/B, SS/567/C } 32/6 the set

Amplifier "B"
SS/567/A ... 16/6

G.E.C. 88-50 Pre-Amplifier

Input Selector (state number of positions) ... 12/-
Treble Selector ... 7/9

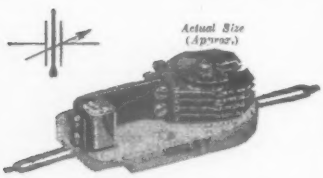
Write for Price List and Design Chart.

SPECIALIST SWITCHES
23 Radnor Mews - Sussex Place
London W2 - AMBassador 2308

Suppliers to the leading electronics, aeronautical and automobile companies and to research institutions, the G.P.O. and Universities.

Excellence in design..

Specialists in Subminiature Telecommunication Components.



TEMPATRIMMER

Nominal capacity 6.5pF—Temperature Coefficient continuously adjustable from + 2000 to — 2000 parts per million per degree Centigrade. Length 1.31" Width .670" Height .5"

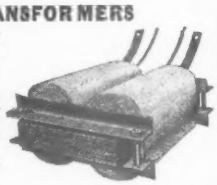
Details from—

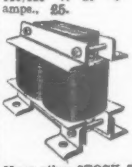
OXLEY
DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANCS
Tel: ULVERSTON 3306

TRANSFORMERS

Input voltage either 220/250 v. or 400/440 v. Please state which.

OUTPUTS:
2-6-9-12 v. at 65 amps., £5. 6-12-18-24-30 v. at 12 amps., £5. 5 v. at 300 amps. £5/5/-. 12v. at 20 amps., £5. 110/120 v. at 6 amps., £5.

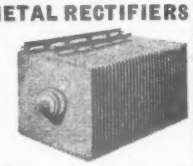




10 v. at 1,000 amps. ..... £32.
8 v. at 500 amps. ..... £24.
3-5-8-10-15-17-21-25 v. at 100 amps. ..... £19.
60 v. at 40 amps. ..... £15.
60 v. at 90 amps. £17
110/120 v. at 25 amps. .... £17.

Many other STOCK TRANSFORMERS with outputs up to 25,000 amps. at low voltages. We specialise in transformers with LOW VOLT/HIGH CURRENT outputs.

FULL-WAVE METAL RECTIFIERS



6/12 v. 5 amps., £1/5/-
6/12 v. 10 amps., £2/5/-.
12 v. 20 amps., £4.
24 v. 12 amps., £4.
24 v. 30 amps., £10.
36 v. 50 amps., £17.
And others

TRANSFORMER—RECTIFIER SETS

Input voltage 200/260 v. A.C.

OUTPUTS:
80-115 v. D.C. at 25 amps., £35.
110/120 v. D.C. at 8 amps., £19.
220/250 v. D.C. at 6 amps., £32.
36 v. D.C. at 50 amps., £26.
12-30 v. D.C. at 12 amps., £14.

Other Transformer—Rectifier Sets with output currents up to 200 amps.

HARMSWORTH, TOWNLEY & CO.
2 JORDAN STREET, MANCHESTER 15
Phone: CEN trol 4261 Grams: Weldfix, Manchester, 15.

OPPORTUNITIES IN RADIO

Get this FREE Book!

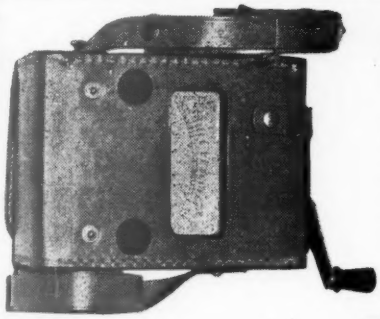
'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 148 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study course in all branches of **TELEVISION and RADIO, A.M. Brit. I. R. E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency and General Wireless Courses.**

We definitely Guarantee
"NO PASS—NO FEE"

If you're earning less than £18 a week this enlightening book is for you. Write for your copy today. It will be sent **FREE** and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
339b COLLEGE HOUSE,
29-31 WRIGHT'S LANE,
LONDON, W.8

BIET



EVERSHED AND VIGNOLES NEW TEST EQUIPMENT offered at fraction of makers' price. **"WEE MEGGER,"** complete in leather case, brand new and perfect, as illustrated.
100 volt **£6** each P. & P. 2/6. 250 volt **£10/10/-** each. P. & P. 2/6. 500 volt **£12/10/-** each. P. & P. 2/6.

EVERSHED AND VIGNOLES CIRCUIT TESTING OHMS METER. Pattern "S," complete with test prods, inst. book, etc. Two ranges 0–3 and 0–30 ohms. Brand new, guaranteed perfect, as illustrated. **£4/17/6.** P. & P. 2/6.

EVERSHED AND VIGNOLES Series II metal cased meggers, 500 volt. Used, but in perfect working order, complete with leather carrying case. **£20** each. P. & P. 5/-

METERS
Brand new, guaranteed perfect

5 amp. D.C. M.I. 2½in. Fl. Rnd.	11/6
7½ amp. D.C. M.I. 3½in. Rnd. Pr.	12/6
1 mA. M.C. 2½in. Fl. Rnd.	22/6
50 mA. M.C. 2in. Sq.	7/6
200 mA. M.C. 2½in. Fl. Rnd.	9/6
25 v. D.C. M.C. 2in. Fl. Rnd.	7/6
300 v. A.C. M.C. 2½in. Fl. Rnd.	22/6

Dual range pocket volt meter 0–25 and 0–250 v., in wallet. **12/6.**
Ex equip. 500 microamp. 2in. scaled. 0–15 and 0–600 v. **14/6.** M/c.
P. & P on all meters 1/- each.

HEADPHONES

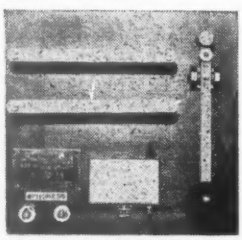
4,000 ohms, imported, new.	15/-
2,000 ohms, "Ivalek," Brit. New	12/6
L.R. M/c. S. G. Brown.	12/6
H.S.30 L.R. U.S.A., min. ear pcs.	15/-

P. & P. on above 1/6 each.

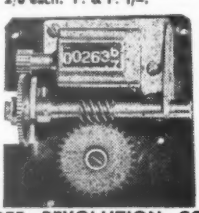
MICROPHONES—NEW

Throat, British, magnetic.	4/6
Throat, carbon, U.S.A.	3/6
No. 8 carbon with switch.	7/6
Type 48, ex oxy. mask.	3/6

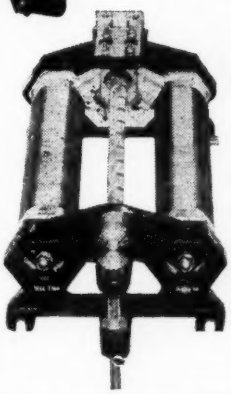
P. & P. on above 1/- each.



Morse Practice Set, polished wooden base, tapper, adjustable buzzer, battery clips and terminals. Brand new, original manufacturers' packing. **8/6** each. P. & P. 2/-.
Morse Keys. 8-ampere Service patt. New. **2/6** each. P. & P. 1/-.



VEEDER REVOLUTION COUNTER. 6 columns, fitted reduction drive, built inside small unit. New. **8/6** each. P. & P. 2/-.



SLIDER RESISTANCE, heavy duty type, 79 ohms, two barrels with gear drive, 2.9 amp–.65 amp. New. **22/6** each. P. & P. 3/6.

CONTROL PANEL containing 50 ohms 50 watt Rheostat and toggle switch, in crackle finished metal case. New. Ideal for model control. **8/6** each. P. & P. 2/6.

DYNAMOTOR 6 volt in 250 volt out at 100 mA, ex new equipment. **25/-** each. P. & P. 3/-.

U.S.A. GENERATORS TYPE PP77D. Briggs and Stratton petrol driven motor driving generator supplying 115 volts 250 watt direct current. New. Original c ses. **£25** each. Carr. £1.

AUTO TRANSFORMERS, step up, step down, 110 v.–200–220–240 v. Fully shrouded. New.
350 watt type **£2/2/-** each. P. & P. 4/6. 500 watt type **£3/3/-** each. P. & P. 4/6. 1,000 watt type **£4/4/-** each. P. & P. 4/6.

Armour Recording Wire. U.S.A. Top quality on original reels, length 3,700 yards. **17/6.** P. & P. 1/6. New.

Telephone Handsets, sound power, pair will work by simple connection without batteries. Good condition. **22/6** each. P. & P. 1/9.

Telephone Handsets. U.S.A. Similar to G.P.O., with switch, carbon insert, new. **12/6** each. P. & P. 1/6....

Photo Multiplier. Type 931A, for Alfa counting, film scanning, spectography, etc., new. **£2/5/-** each. P. & P. 1/-.

WHEATSTONE BRIDGE UNIT. 4-stud switches 0–10, 0–100 ohms, galvanometer centre zero, F.S.D. 2.5 mA. In oak carrying case 16×7½×6in. **40/-** each. P. & P. 3/6.

MUIRHEAD VERNIER DRIVE. Scaled 0–180 degrees, ratio 31/1, dia. 3in., as fitted to R.F.26 units. Complete with lampholder. In manufacturers' original packing. New. **8/6** each P. & P. 1/6.

INSULATION TESTER BY HIVOLT. Breakdown insulation tester with variable voltage from zero to 45 kV. Reads in microamp as leakage, incorporates adjustable trip control. Normal Mains input, complete with all leads, etc. As new. Maker's price over £200. Our price **£40** plus carr. in England £1.

Londex Relay, 24 v. heavy silver contacts, two breaks. Fair condition. **4/6** ea. P. & P. 1/-.

High Speed Relay, Siemens, two bobbins 1,000 ohms, each. New. **10/6** each. P. & P. 1/-.

Neon Light, 230 v. A.C. M.B.C. Clear, **1/9** each, P. & P. 6d.
Ultra Violet Bulb, AC/DC 12 v. 36 watt. New, **5/6.** P. & P. 6d.

Fishing Rod Aerials, 12ft. (3 x 4ft. sections). Steel, copper plated, tapered top. Ideal aerial or fishing rod. Fair cond. **8/6** each. P. & P. 2/6.

Latest type Collaro Studio miniature Microphones. Complete with screened jack plug. New. **37/6** each. P. & P. 1/-.

Infra-red Telescope, complete with 3-section zamboni pile, image converter tube and full optical system. Brand new, complete with hide carrying case. **17/6** each. P. & P. 2/6.

L.T. Transformer. Input 230 v. Output 50 v., 50 ampere, with meter voltage regulator switch on primary. In steel case fitted with mains switch, will take 100% overload. Grs. wt. 150lb. Wound at 800 amps. per sq. in. New, in manufacturers' cases. **£15** each. Carr. in Eng. £1.

Potted L.T. Transformer. Oil filled Input 230 v. Output 2-4-14-22-30-38 v. at 7 amp. Conservatively rated. New **£2/15/-** each. Carr. in England 6/6.

24 V. Blower Motor. AC/DC, will run on 12 v. Operational condition. **12/6** each. P & P. 3/-.

200/250 v. A.C. Motors. New, 1/80 h.p., 2 drives, direct 6,000 r.p.m., reduction 300 r.p.m. **22/6** each. P. & P. 2/6.

Miniature 24 v. D.C. Reversible Recorder Motors. Fitted governor and right angle gear drives, 3×1×1½in. New. **12/6** each. P. & P. 2/-.

SMOOTHING CHOKES

10H.	150 mA. 450 ohms	10/6
20H.	50 mA. 300 ohms	8/6
20H.	100 mA. 270 ohms	11/6
20H.	150 mA. 160 ohms	14/6

P. & P. 1/9.

ASK FOR EXPORT QUOTATIONS **WE ARE EXPERTS AT OVERSEAS PACKING & SHIPPING!**

SERVICE TRADING Co.

PERSONAL CALLERS ONLY: **9 Little Newport Street, London W.C.2.** *Tel: GER 0576*
ALL MAIL ORDERS: **47-49 High Street, Kingston-on-Thames** *Early Closing Thursday*

B. ADLER & SONS (Radio) Ltd.

COMPLETE No. 1 HEADGEAR

consists of low impedance padded headphones and No. 7 hand microphone with moving coil insert. For use with Army No. 19 set and all other Army Transreceivers Price 10/-. P. & P. 3/6.

AMERICAN MOVING COIL INSERTS. Tested. ONLY 6/6 each.

HEADPHONES

TYPE D.L.R.5. Single earpiece with cord, plug and canvas headband. ONLY 4/-. P. & P. 1/6.
COMPLETE D.L.R.5 Headphones 7/6 per pair. P. & P. 1/6.

LOW IMPEDANCE PADDED HEADPHONES with metal headband (as illustrated above). 7/- per pair. P. & P. 2/-.

HIGH RESISTANCE EARPIECES. 1,000Ω Brand new. 3/6 each.

C.L.R.3 LOW RESISTANCE. Complete with cord and plug Brand new. Only 6/6 each.

Please send us your enquiries for all types of Microphones and Headphones, we can offer the keenest prices in the country.
EXPORT ENQUIRIES A SPECIALITY

MICROPHONES

All types available. All Brand New.

No. 8 (*as illustrated*). Blue Carbon Insert. Complete with cord and plug. ONLY 5/-. P. & P. 1/6.

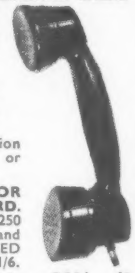
No. 3A. Refillable Carbon Insert. Finished in Red and Black bakelite with white rubber mouthpiece. Cord, plug and canvas neckband. 6/6. P. & P. 1/6.

TANNOY POWER MICROPHONES ONLY 10/- each.
BLUE CARBON INSERTS. Brand New. ONLY 3/6 each.
DESK MICROPHONES. Candlestick type. Red Carbon Insert with lead and plug. ONLY 9/6. P. & P. 2/6.
AMERICAN LIGHTWEIGHT THROAT MICROPHONES. Type T.S.30. ONLY 2/6.

AERIALS

1 FOOT SECTIONS. Can be extended as required. Only 6d. each or 5/- per dozen.
F. ROD AERIALS. Bottom sections 4 feet Copper Plated. Can be used to form Beam Antenna or complete Aerial Masts. 2/3 each or 6 for 12/-. Please add carr.

STANDARD TELEPHONE HAND SET



With sound powered earpiece and Carbon mike. Press to talk. UNUSED with cord and plug. ONLY 12/6. P. & P. 2/6.

AMERICAN MINIATURE MICRO SWITCHES. On/off or off/on, mains 1 amp. Size 1 1/16" × 1/2" × 1/2". Ideal for furniture manufacturers. Fraction of original cost. 2/6 each or 25/- per doz.

OPERATOR'S UNITS FOR 10 LINE SWITCHBOARD. Consisting of Jack socket, 250 mfd. condenser, rectifier and handset socket. UNUSED ONLY 5/- each. P & P. 1/6.

COMPLETE UNIVERSAL CALL 10 LINE SWITCHBOARD. In working order. Price on application.

MORSE TAPPER AND PLUG ASSEMBLY. Consisting of 8 amp. morse key, igranic plug on lead. Brand new. Price only 3/6 each. P. & P. 1/-.

TELEPHONE BUZZERS. YA.0222. T.MK.1. 6 contact. Tested. ONLY 6/- each.

6-VOLT CUT-OUTS. Consisting of two 3-amp. contacts, 30 ohm coil and 4-pin Jones socket. Brand New. 2/6 each. P. & P. 1/-.

WIRELESS SET No. 19

MK. II (made by ZENITH). Two transmitter-receivers and an intercom amplifier in one case. "A" set covers 2—8 mc/s. RT and CW, and "B" set 240 mc/s, RT only. Complete with 15 valves and 500 Micro amp. check and Tuning Meter. Only 60/-, plus 10/- carr.

KING'S HEAD YARD, COPTIC ST., LONDON, W.C.1 Tel.: MUSeum 9606

THESE NEW DUODE UNITS ARE A REAL TONIC

The new **Duode** 12C and 12B/C with dense foam surrounds have now been going out for some months, winning many golden opinions:
Duodes have always been famed for their crystal clarity and absolute control of complex sounds. This new dense foam achieves a small but definite improvement which keener ears will appreciate, in that it gives a better termination to the cone edge and damps out energy reflections.
The unique **Duode** drive with its built-in feedback and crossover is the heart of **Duode** quality and naturalness.

A NEW DUODE IS THE FINEST LONG TERM INVESTMENT IN GOOD SOUND

Write today for details to:—

DUODE LTD.
c/o The Gramophone
11 Greek St., London, W.1.

LINE AND RADIO COMMUNICATIONS

TELEPHONE CARRIER EQUIPMENT: Carrier Terminals, Repeaters, associated Filter Units and spares for Systems 1+1 and 1+4—Carrier Link S.E.—Apparatus Selective Carrier 28-Channel and 12-Channel Terminal Units.

TELEPHONE SWITCHBOARDS AND FIELD SETS: Switchboards P & P 20-Line and 40-Line—Switchboards U.C. 10-Line—Field Sets Types D, F, H and L.

TELEPRINTER SYSTEMS: Teleprinters tape and page Keyboard Perforators, Transmitter Heads, Reperforators and Printers tape and Page Carrier Equipment Speech+Simplex, Speech+Duplex, 3-Channel Duplex and Apparatus 2/4 Tone No. 5 Carrier and Ringing Repeaters.

LINE TEST EQUIPMENT: Test Sets EE65—Networks Balancing and Testing—Recording Bridges—Diversity Combining Units—Testers TMS No. 1.

TRANSMITTERS: H.F. Communications, Hand or High-Speed Keying, Crystal or M.O control, Temperature compensated M.O. Circuit. Frequency range 1.5 to 20 mc/s. C.W., M.C.W., and R/T 100% Modulation. 300 Watt Carrier output all systems.

AN/GRC SERIES: Communications stations with all operating equipment and spares SCR-508, SCR-509, SCR-610.

LOW POWER TRANSMITTER/RECEIVERS: Aircraft V.H.F. Equipment AN/ARC-1 50-Channel. Stations and Sub-Assembly Units TR 1520, 1934, 1935 and 1936 10-Channel V.H.F. Equipment.

RADIO COMPASSES: SCR-269G with all operating equipment.

WIRELESS SET 19: Stations with all operating equipment and R.F. Amplifier for boosting output.

WIRELESS SET 62: Lightweight Communications sets with ancillary equipment.

T.C.S. SERIES: Equipment with all ancillaries and Power Supply Units for 12v. D.C., 24v. D.C., 115v. A.C and 230v. A.C. supply.

WIRELESS SET 88: Walkie-Talkie Sets 4-Channel.

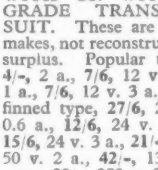
R. GILFILLAN & CO. LTD.
7, High Street, WORTHING, Sussex.
Tel.: Worthing 8719 and 30181.
Cables: "GILL WORTHING" Codes: "BENTLEY'S 2nd"

SELENIUM RECTIFIERS

40 ma. to 10 amp., 6 v. to 100 v. Bridge, H. Wave or P.P.

WITH OR WITHOUT HIGH-GRADE TRANSFORMER TO SUIT. These are new goods, best makes, not reconstructed Government surplus. Popular types, 6 v. 1 a., 4/-, 2 a., 7/6, 12 v. 2 a., 8/6, 12 v. 1 a., 7/6, 12 v. 3 a., 15/-, 6 a. alloy-finned type, 27/6, 24 v. 0.3 a., 9/-, 0.6 a., 12/6, 24 v. 1 a., 13/6, 2 a., 15/6, 24 v. 3 a., 21/-, 50 v. 1 a., 24/-, 50 v. 2 a., 42/-, 130 v. 300 ma. h. wave, 38/-, 250 v. 300 ma. do., 65/-, 110 v. 1 a. bdge., 48/-, 130 v. 80 ma. bdge., 21/-. Postage 9d. extra each.

CHARGER KITS



No. 1, a kit for 2 v., 6 v., 12 v., 3 amp. transformer, rectifier, ammeter, all high-grade new parts, not rubbish, 52/6, unique convector housing for same, as illust., 12/6, p.p. 3/-, ditto, but 2 amp., 43/-, case 12/6, p.p. 3/-.

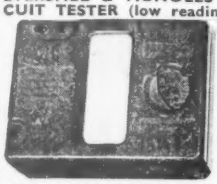
Economy 12 v. 3 amp. kit, no ammeter needed, 34/6, p.p. 2/6, all with 12 months' guarantee.

CHAMPION PRODUCTS
43 UPLANDS WAY, LONDON, N.21
Telephone LAB 4457

BARGAINS IN TEST EQUIPMENT

VALVE TESTER, TYPE 4. 200/230 v. A.C. input. Ex Govt., in good condition, with descriptive book containing circuit diagram of instrument and how to test valves from 1.4 v. to 40 v. With valve holders for Brit., 4, 5, 7 pin and Octal, U.S., 5 and 7 pin, 1/Octal, side contact large Brit., 4 and 9 pin. Acorn and diode. Housed in substantial wooden case. **£7/19/6.** Carr. 10/-.

EVERSHED & VIGNOLES MEGGER CIRCUIT TESTER (low reading ohm meter).

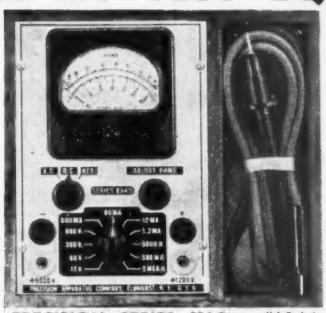


2 ranges. 0-3, 0-30 ohms. The perfect meter for continuity and polarity testing. Complete with test leads and ready to use. Brand new. Only **£4/17/6.** P. & P. 3/-.

AVO TEST BRIDGE. A.C. mains operated from 200-250 v. Will test Resistance from 5 ohms to 50 megohms and Capacity from .00001 to 50 mfds. A most useful instrument for everyday uses. Our price ONLY **£7/19/6.** P. & P. 3/6.

RE-ENTRANT LOUDHAILERS (Ex-Govt.). Heavy duty 20 watts all-metal. 15 ohms. Diameter 18in. length 12in. (approx.). Perfect condition, **£6/10/-**, carr. 10/-.

PARMEKO TWIN BAKELITE LOUD HAILERS (Ex-Admiralty). Mounted on metal base. Complete with 600 ohm line transformer. 15 ohm voice coil. Ideal for P.A. and all outside work. Length 15in., height 9in., dia. of horns 8½in. Price **45/-**, carr. 7/6.



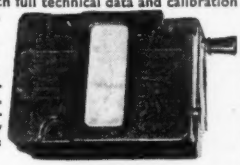
PRECISION SERIES 834-S. (U.S.A.) Multi range tester for A.C./D.C. volts, ohms and milliamps. Basic movement 400 microamps. Housed in wooden box with lid and carrying strap. Overall size 7½in. x 7in. x 5in. Complete with test prods, batteries, etc. Ready to use. **£6/19/6.** Post 2/6.

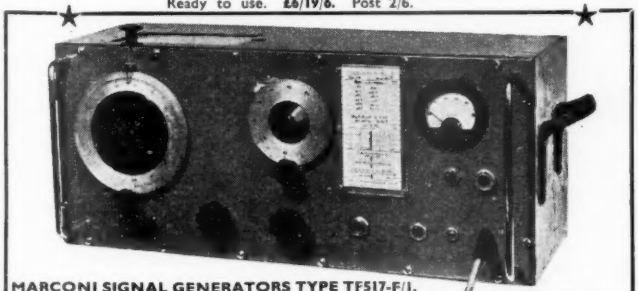
METERS. 0-1 m/a. 2in. circular F/M **17/6.** Ditto 2½in., **25/-.** 0-50 microamps, D.C. m/c., projecting 2½in. round, **49/6.** 0-10 mA. A.C. m/c., rectifiers, F/M 3½in., round, **49/6.** 0-300 v. A.C. 2½in. F/M, **25/-.** 0-200 v. A.C. 3½in. F/M, **25/-.** 0-300 v. A.C. 3½in. F/M, **25/-** each.

RECORD MEGGERS. 500 v. insulation tester, 0-50 megohms. In leather case, good condition. **£8.**

TEST SET TS-26/TSM. This volt ohmmeter is the correct tester for EE8 telephones and all standard telephone equipment. Brand new and boxed, with full technical data and calibration charts. **£7/10/-.**

EVERSHED AND VIGNOLES WEE MEGGER 250 v. New and unused. Only **£10/10/-.** P. & P. 3/-.





MARCONI SIGNAL GENERATORS TYPE TF517-F/1. Covering 10-18 Mc/s, 33-58 Mc/s, 150-300 Mc/s. Used but in very good condition. Complete with full technical data and instructions. Limited quantity. Unrepeatable at only **£12/10/-.** carr. 20/-.

6 V. 125 A.H. STORAGE BATTERY in wooden carrying case New and unused. Size 15½ x 11 x 7½in. **69/6.** Carr 10/-. DITTO. 40 A.H. Size 10½ x 9½ x 5in. **21/-.** Carr. 5/-.

ACCUMULATORS. Bakelite cased 2 v. 100 ampere 75 actual. Ex Govt. New and unused. Complete with carrying handle. Size 6½in. x 6½in. x 3½in. **15/-** each. Carr. 3/6. 3 sent for **50/-** or 6 for **£5** carr paid. Ditto, 14 A.H. less handle **5/6.**

OLDHAM MINERS' LANTERN (all steel). 9½in. tall, 3½in. dia. Complete with bulb and rechargeable accumulator. Ideal inspection lamp for garages, outhouses etc. **19/11.** Post 2/6.

TRANSFORMERS

RCA PLATE TRANSFORMERS. 190 to 250 v. primary. 50-60 cycles. Secondary 1,500-0-1,500 or 2,000-0-2,000, at 1.75 k.v.a. Brand new and boxed. **£12/10/-.** Carr. 10/-.

L.T. TRANSFORMERS. Pri. 200-250 v. 50 cycles A.C., Sec. 17.5 v. at 35 amps. **£4/15/-**, carr. 10/-.

TRANSFORMER (FERRANTI). Potted for 0-250 v. 50 cycles tapped primary, sec. 1,250 v., 15 mA. Ideal for oscilloscopes, etc. Size 3⅜ x 3⅜ x 4½in. ONLY **35/-.** P. & P. 2/6.

VARIABLE VOLTAGE REGULATOR TRANSFORMERS. Input 230 v. A.C. at 21 amps. Output 57.5 volts in 16 equal steps to 230 v. at 21 amps. Ex Govt., in perfect condition. **£12/10/-**, carr. 15/-.

E.H.T. TRANSFORMERS. 3,850 v. at 50 mA. with two additional 4 v. L.T. windings, for 230 v. 50 cycles primary. New and boxed. **£3/15/-.** Carr. 5/-.

TRANSFORMERS. 110-230 v. Pri. Sec. 26 v. tapped to 41 v. at 14 amps. New and boxed. **£3/10/-.** Carr. 5/-.

CAR RADIO VIB. TRANSFORMERS. 6 v. Input 280 v. at 80 mA. H.T. (ex Philco). New, in perfect condition. **12/6.** P. & P. 2/-. Ditto 12 v., same price.

E.H.T. TRANSFORMER. 20 kV. at 140 m/a. 230 v. 50 cycles primary. New and unused. Ex Govt. Built to the highest specification. **£22.** Carr. 30/-.

TRANSFORMER. 1,800-0-1,800 at 1 kVA, 230 v. 50 cycles primary. Fully tropicalised. New and boxed. **£8/15/-.** Carr. 10/-.

18/24 v. 10 AMP. BATTERY CHARGERS for 200-250 v. 50 cycles input, metered, switched and fused. As new. **£12/10/-.** Carr. 20/-.

A.C.-D.C. RECTIFIER POWER SUPPLY UNIT. 230 v. A.C. 50 cycles input. 100 v. D.C. output max. 2½ amp. **£4/10/-.** Carr. 7/6.

SELENIUM METAL RECTIFIERS. F/B.

6 or 12 v. 1 amp. ...	7/6	24 v. 1 amp.	13/6
12 v. 2 amp.	10/-	24 v. 2 amp.	20/-
12 v. 2½ amp.	15/-	24 v. 2½ amp.	25/-
12 v. 4 amp.	16/6	24 v. 4 amp.	30/-
12 v. 6 amp.	23/6	24 v. 6 amp.	35/-
12 v. 10 amp.	40/-	24 v. 10 amp.	80/-

SPEEDY DELIVERY OF ALL TYPES OF RECTIFIERS HALF WAVE F/B, SINGLE PHASE OR THREE PHASE TO ORDER. FULLY GUARANTEED.

C.M.G. 25 PHOTO CELLS (OSRAM). Brand new. **15/-.** P.P. 1/-.

B.C.929A CRT INDICATOR UNIT. Containing 1-3PB1 3in. C.R.T., 3-6SN7s, 2-6H6s, 1-6G6, 1-6X5, 1 2X2; 8 valves in all. Ideal for 'scope conversion. New, in original sealed cartons. **70/-.** Carr. 5/-.

ROTARY CONVERTERS, Ex-Govt. 12 v. D.C. input 230 v. A.C. Output 50 cycles at 135 watts. Complete in carrying case, with voltage control, sliding resistance, mains switch and 0-300 v. A.C. flush meter. In perfect working order, **£10.** carr. 10/-.

12 v. D.C. to 230 v. A.C. 50 cycles, 100 watts. Fully tested. **£6/9/6.** Carr. 7/6. Ditto 24 v. D.C. **£4/17/6.** Carr. 7/6.

MICROPHONE STANDS. 3 sections of 18½in. Extends to 56in. Stands on 3 legs which fold together. **21/-.** P. & P. 2/6.

G.P.O. 19in. RACKS. Heavy channel 4ft. 10in. high. **59/6** Carr. 10/-. Undrilled 14 S.W.G. steel panels for above with hinged cover, finished blue-grey. New and unused. **15/-.** P. & P. 5/-. Post free with rack.

CATHODE RAY TUBES. VCR139A 2½in., **30/-**; 3BP1, 3in., **30/-**; 5FP7, 5in., **35/-**; VCR97 6in., **20/-**; All new and unused. P. & P. 3/- each.

TRANSMITTERS AND RECEIVERS

R.C.A. AR88 D. RECEIVER. In very good condition. Frequency range: 540 kc/s to 32 Mc/s continuous on 6 wavebands. Tested and aligned before despatch. **£55,** carr. paid U.K. only.

AIRCRAFT RADIO RECEIVERS BY RCA (Model No. CRV 46151). Freq. 195 kc/s to 9,050 kc/s. (33-1,500 metres) continuous. For 28 v. D.C. input with built-in dynamotor. This 6-valve receiver with 2 R.F. stages and 2 I.F. stages, B.F.O. and C.W. **£10,** or complete with A.C. mains power-unit for speaker or 'phones. Ready for use. **£15/10/-.** Carr. 10/-.

R109A RECEIVERS. Freq. range 2-12.0 megs. In good working order **£4/7/6.** Carr. 10/-. A.C. mains 200-250 v., power packs available. **£4.** Carr. 5/6.

TRANSMITTER-RECEIVER No. 19. Mk. II complete with 15 valves. Frequency range A set 2-8 meg., B set 230-240 Mc/s, in good condition. **£2/19/6.** Carr. 10/6. 12 V. ROTARY POWER UNIT for above. **£1.** Carr. 5/-. All leads, headsets, variometers, etc. available

BENDIX RECEIVER M.N.26.Y. Frequency range in 3 bands 150-325 kc/s., 325-695 kc/s., 3.4-7 mc/s. This 11-valve superhet is complete with dynamotor and in perfect condition. Supplied with connection details. **70/-.** Carr. 8/6.

COMMAND TRANSMITTERS. 4 to 5.3 megs. Complete with valves and crystal. New and boxed. **35/-.** Post 3/-.

COMMAND RECEIVERS. B.C. 454, 3-6 Mc/s. Brand new. **39/6.** 455, 6-9 Mc/s. **39/6.** P. & P. 3/- each.

Hours of Business:
9-6 Weekdays
9-1 Saturday

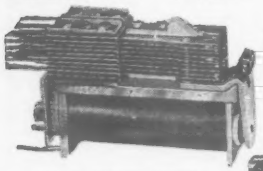
GEE Bros. RADIO Ltd.

ADJOINING
LEICESTER SQ.
TUBE STATION

15, LITTLE NEWPORT STREET, LONDON, W.C.2. Telephone: GERrard 6794/1453

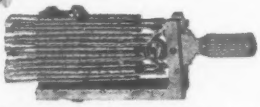
SPECIAL TERMS FOR QUANTITIES—EXPORT ORDERS PROMPTLY EXECUTED

RELAYS P.O. TYPE 3000.



BUILT TO YOUR SPECIFICATION
QUICK DELIVERY KEEN PRICES
CONTACTS UP TO 8 CHANGEOVER

RELAYS—HIGH SPEED. Miniature, sealed. 1700+1700Ω. **25/-** each. Post 1/3.



KEY SWITCHES

PROMPT DELIVERY ALL TYPES
UP TO 4co/6co

NIFE BATTERIES. Practically indestructable. 1.2 Volts 70 amp. Alkaline filled. Any voltage can be built up. Brand New. **25/-** each. Cge. 5/-.
WAVEMETER. With all leads and spares. 180/220 Mc/s. This fine unit contains a 2½in. milliameter 1FSD, 3 valves, pilot lamp, switch and other useful parts. The case 9×9×12½in. with hinged lid is adaptable for many purposes. BARGAIN PRICE **50/-.** Carriage 7/6.
SIGNAL GENERATOR. Type 52a. 4 bands from 6 to 52 Megacycles inclusive. 230 volt. Complete with all leads, etc. Brand new in transit case. **£10.** Carriage 7/6.

METERS GUARANTEED

	F.S.D.	Size	Type	Price
100	Microamps	2½in.	MC/FR	50/-
250	"	3½in.	MC/FR	55/-
500	"	2in.	MC/FS	27/6
500	"	2½in.	MC/FR	37/6
1	Milliamps	2in.	MC/FS	27/6
1	"	2½in.	MC/FR	35/-
5	"	2in.	MC/FR	17/6
30	"	2½in.	MC/FR	12/6
100	"	2½in.	MC/FR	12/6
200	"	2½in.	MC/FR	12/6
300	"	2½in.	MC/FR	12/6
5	Amperes	2in.	MC/FS	27/6
25	"	2½in.	MI/FR	7/6
50-0-50	Amp.	2in.	MC/FS	12/6
20	Volts	2in.	MC/FS	10/6
40	"	2in.	MC/FS	10/6
300	" A.C.	2½in.	MI/FR	25/-
300	" A.C.	6in.	MI/FR	150/-

CROSS POINTER METERS. With 2 separate 100 microamp movements. Brand new. **22/6.** Post 2/-.

CIRCUIT TESTER in case. Meter 50 milliamps. **17/6.** Post 2/6.

AVO TEST BRIDGES. 220/240 volt A.C. Measures capacities from 5 pf to 50 mfd and resistances from 5 ohms to 50 megohms. Valve voltmeter range 0.1 to 15 volts, and condenser leakage test. BRAND NEW. Full working instructions supplied with instrument. **£9/19/6.** Post 3/-.
TEST SETS incorporating a Wheatstone Bridge, galvanometer. Brand new, in case, **50/-.** Post 3/6.
CELL TESTING VOLTMETERS. 3-0-3. In leather case with prods. A first-quality moving-coil meter. **25/-.** Post 2/-.
OUTPUT POWER METER No. 5, with 3½in. Flush Round Microammeter 100 F.S.D., **80/-.** Post 3/-.
"WEE MEGGER" INSULATION TESTERS, 500 volts, in leather case, **£10/-.**
BRIDGE MEGGER TESTERS 500 volts **£45.** 1,000 volts **£75.**
"MEGGERS" (metal case) 500 volts **£25.** All Guaranteed.
LEATHER CARRYING CASES, 12in.×7in.×9in. with lock, key and strap. For Bridge Meggers and many other purposes, **60/-.** Post 3/-.
SCREENED FLEX. Single, 14/0048 thermoplastic P.V.C. **9d.** per yd.; **8d.** per yd. in 12 yd. lengths; **6d.** per yd. in 500 yd. coils.
TELEPHONES—SOUND POWERED—NO BATTERIES REQUIRED. Just connect with twin flex for clear speech. Transmitter/receiver units. **4/6** each. Twin flex 4½d. yd. Post 1/-.
TELEPHONE SETS. For perfect communication between 2 or more positions. Wall Type, one pair of units, **85.** Batteries **5/6.** Twin wire **5d.** yard. Desk Type, now available, latest modern style. Two complete units ready for use, **£8/17/6.** Wire **3d.** per yard. Post 3/6.
ROOM THERMOSTAT. Adjustable between 45 and 75 deg. Far., 250 v. 10 amp. A.C. Ideal for greenhouses, etc., **35/-.** Post 2/-.
HEATING ELEMENTS. Flat enclosed type. 230 volt 500 watt. "Bray chromalox." 10×1½in. **7/6.** Post 1/6.
CHARGING RECTIFIERS. Full wave Bridge. 12 volts 2 amps., **13/6.** 4 amps., **22/6.** Suitable transformers 2 amp., **24/-.** 4 amp., **29/6.** Post 2/-.
JACK PLUGS. Cylindrical bakelite screw-on cover. 2 contact. Ideal for amplifiers, etc., **2/6** each, **24/-** doz., **£9** per 100.

GEARED MOTORS for the model maker, small and very powerful. 12/24 volt D.C., 4/6 r.p.m., **38/-,** post 2/6. Will work from 230 volt A.C. mains with our transformer and rectifier **17/-** extra.

PORTABLE BLOWERS. 200/250 v. A.C./D.C., 300 watts with switch and leads, 1½in. outlet. **85.** Post 3/6.
VERNIER DRIVES. Muirhead scaled 0/180 deg. Ratio 38 to 1. Diam. 3in. **10/6.** Post 1/6.
HEADPHONES. Balanced Armature Type DHR. **17/6** per pair. Post 1/6.
HEADPHONES. High resistance 4,000Ω Type CHR, new, **12/6** pair. Post 1/6.
VENT AXIA FANS—EXTRACTION OR INTAKE. 230/250 volts A.C. 6in. diam. blades. **130/-.** 12 volt D.C., **90/-.** Post 2/9.
WHEATSTONE RESISTANCE BRIDGE. 1 to 10,000 ohms. Plus type, **85.**
SWITCHES. 1 hole fixing, 3 amp. 250 volt. Single pole change over, **1/6** each, 12/- doz. **£37/10/-** per 1,000.

L. WILKINSON (CROYDON) LTD.

19, LANSDOWNE ROAD, CROYDON
Phone: CRO 0837. Telegrams: "WILCO", CROYDON

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1. (Coventry Street end)
Phone: No. GERrard 3977/8 *Grams: "Radiotrade"*

STOCKISTS OF CARR FASTENER COMPONENTS

SPECIAL OFFER OF CURRENT MANUFACTURE ELECTROLYTIC CONDENSERS
8 mfd. 450 v. 2/6 each; 16 mfd. 450 v. 3/-; 32 mfd. 450 v. 4/-; 8 x 8 mfd. 450 v. 3/9; 8 x 16 mfd. 450 v. 4/-; 16 x 16 mfd. 450 v. 4/6; 32 x 32 mfd. 350 v. 5/-; Bias Condensers: 25 mfd. 25 v. 1/6; 50 mfd. 50 v. 1/9. Please note we can offer special discounts for quantities

W.W. RESISTORS. 5 watt 1/6; 10 watt 2/6; 15 watt 3/-; 20 watt 3/6 We carry stocks of resistors from 2 watt to 150 watt W.W. Your enquiries invited.

HIGH STABILITY RESISTORS. ½ watt 5% 6d.; ¼ watt 5% 9d; 1 watt 5% 1/-. A few values in 1% and 2% still available.
ALL ORDERS FOR RESISTORS C.O.D. PLEASE, AS WE CANNOT GUARANTEE TO STOCK ALL VALUES.

ELECTROLYTIC CONDENSERS. Manufacturers' Surplus, in perfect condition. 100 mfd. x 200 mfd. 350 v. surge 5/6 each; 100 mfd. x 100 mfd. 425 v. surge 5/6 each; 150 mfd. 450 v. wkg. 5/6 each.

BIAS CONDENSERS. 3,000 mfd. 6 v. 3/6 each; 2,500 mfd. 3 v. 3/6 each; 1,000 mfd. 12 v. 1/6; 25 mfd. 25 v. 1/3; 50 mfd. 12 v. 1/-.

TRANSISTORS: Junction type Red Spot by well-known manufacturers 10/- each.
TRANSISTOR CONDENSERS: Miniature Electrolytic Capacitors 32 mfd. 3 v., 25 mfd. 25 v., 25 mfd. 6 v., 16 mfd. 12 v., 8 mfd. 6 v., 5 mfd. 12 v., 2.5 mfd. 25 v., 1.6 mfd. 6 v., 1 mfd 12 v. All these types of condensers are 3/6 each. SPECIAL DISCOUNTS FOR QUANTITIES.

AIR-SPACED TRIMMERS, 5, 10, 15, 20, 25, 50 and 75 of pre-set and spindle types 2/- each.....doz. 21/-

PYE PLUGS AND SOCKETS 1/6 per pair "T" pieced...each 1/9

GROMMETS, 1 grs. assorted grommets, ¼in. to 1in .....gross 8/6

WESTECTORS. WX6, WX12, W4 1/- each.....doz. 9/-

SIGNAL LAMP HOLDERS. Panel mounting, complete with adjusting lampholder 2/- each.....doz. 21/-

BELLING-LEE PLUGS AND SOCKETS, 5 pin 1/9; 7 pin 2/-; 10in. ..... each 2/6

MANUFACTURERS PLEASE NOTE. We hold large stocks of Nitrogol, Visconol and other block-type Condensers, your enquiries are invited.

0-100 amps. 50 c.p.s. 4½in. **METERS,** £2/10/-; 0-50 amp. Moving Iron 6in. Meters, £3/10/- each. All brand new and boxed.

MIDGET MICA CONDENSERS. .0001, .0002, .0003, .0004, .0005 5/- per dozen.
200 Assorted Moulded Mica Condensers, popular value..... £2 10 0
200 Assorted Silver Mica Condensers, popular values..... £2 10 0
200 Assorted Carbon Resistors, ½, ¼ and 1 watt. Good selection £1 10 0

PAXOLIN SHEET. 18 x 4½ x 1/16in. 1/6; 10 x 10 x 1/8in. 1/6; 20 x 10 x 1/8in. 3/-; 10 x 10 x 1/16in. 2/-; 20 x 10 x 1/16in. 4/-. Minimum P. & Pkg. 1/6

BARGAIN OFFER OF BATTERIES.
4½ v Heavy Duty Bell Battery. Size 6½ x 4½ x 2½in..... 2/6
72 v. H.T. 1.5 v. L.P. Size 6 x 5 x 1½in 2/6
67½ v. Size 2½ x 3½ x 2½in..... 6/6
60 v. H.T. 1.5 v. L.T. 3½ x 3½ x 1½in..... 4/6
All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.

4-way Push Button Units 2/6 each. Knobs for same 3/- per doz.

WEARITE COILS. PA4, PO4, PA5, PO5, 1/3 each.....doz. 12/-

VALVE HOLDERS. Moulded B9A 7/6; B7G 6/-; Int. Oct. 9/-; Eng. Oct. .....doz. 4/6

VALVE HOLDER FITTED WITH LOWER CAN 1/6 per doz. extra. Screening cans for B7G and B9A .....doz. 6/-

JONES PLUGS AND SOCKETS. 4 pin 2/6 per pair; 6 pin 3/6 per pair; 8 pin 4/6 per pair; 12 pin 6/6 per pair. If cover required send 1/6 extra per cover.

POINTER KNOBS. Small black with white line, standard ¼in. spindle ..... doz. 7/6

WANDER PLUGS. Red and black .....doz. 2/-

PHILIPS TRIMMER TOOLS 1/- each .....doz. 10/6

CASH WITH ORDER OR C.O.D. ALL ORDERS DEPT. W.I.

ALL ORDERS FOR LESS THAN £1 ADD POSTAGE.

We invite your enquiries for items not listed

Trade Counter open 9 to 6 Monday to Friday.
Also 9 to 1 Saturdays. Callers welcomed.

WHOLESALE MANUFACTURERS AND EXPORT ENQUIRIES INVITED

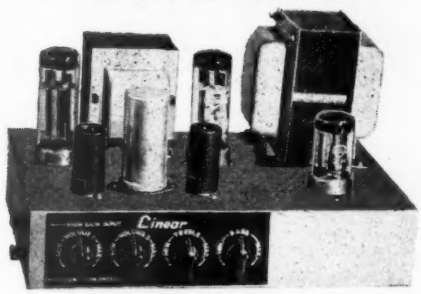
LINEAR

For ***HIGH SENSITIVITY!***
HIGHEST FIDELITY!
MAXIMUM RELIABILITY!
REASONABLE COST!

ANNOUNCING THE 'CONCHORD'

A HIGH FIDELITY 30 WATT AMPLIFIER INCORPORATING PRE-AMPLIFIER AND TONE CONTROLS

EMPLOYING THE LATEST MULLARD EL34 OUTPUT VALVES IN ULTRA LINEAR OPERATION AND HIGH GRADE SECTIONALIZED OUTPUT TRANSFORMER.



Size approx. 13 x 8½ x 7in. Stoved gold hammered finish Weight 14lb. For operation on 200-250 v. 50 c.p.s. A.C. mains. Or other voltages to order. A chrome-handled cover is available at 19/6.

15 GNS. Retail Price

The Following Outstanding Test Figures Include Pre-amplifier and Tone Control Stages

FREQUENCY RESPONSE.
(Exc. Rumble Filter.) ±1 d.b. 20-20,000 c.p.s.

RUMBLE FILTER.
12 d.b. per octave below 50 c.p.s.

BASS CONTROL.
Continuously variable +12 d.b. to −12 d.b. at 50 c.p.s.

TREBLE CONTROL.
Continuously variable. +12 d.b. to −6 d.b. at 12,000 c.p.s.

HUM LEVEL.
Referred to full output −73 d.b.

MAXIMUM POWER OUTPUT.
In excess of 33 watts.

MAINS POWER CONSUMPTION.
110 watts.

STABILITY.
Entirely stable with capacity of .08 mfd. in parallel with loudspeaker load.

EFFECTIVE OUTPUT IMPEDANCE.
0.9 ohms across 15 ohm terminals.

INPUT IMPEDANCE.
Both inputs 500k plus 10 pfd

NEGATIVE FEEDBACK.
Total 28 d.b.

SENSITIVITY.
Input (1) 20 millivolts for rated output.
Input (2) 200 millivolts for rated output.

HARMONIC DISTORTION.
0.05% at 10 watts. 0.1% at 20 watts.

OUTPUT SOCKETS.
Provide matchings for 3 ohm and 15 ohm loudspeakers.

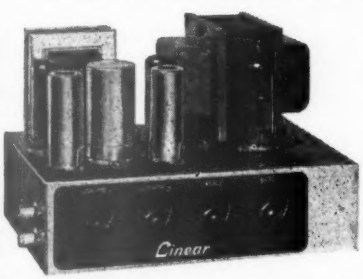
EXTERNAL POWER SUPPLY.
300 v. 30 m/a. 6.3 v. 1.5 a. for radio tuner.

VALVES.
B.V.A. EF86. EF86, ECC83, EL34, EL34, GZ34.
Due to use of Mullard EF86 valves microphony is virtually nil

As in our extremely successful 'Diatonic' two individually controlled inputs provide mixing facilities for microphone and gram., etc., etc.

The 'DIATONIC' HIGH FIDELITY 10-14 WATT ULTRA-LINEAR AMPLIFIER

WITH INTEGRAL PRE-AMP AND TONE CONTROLS



Size only 9-7-6½in. Weight 12½lb. Power consumption 120 watts. Outputs for 3 and 15 ohm loudspeaker.

12 GNS. Retail Price For A.C. mains 200-250 v. 50 c.p.s. finish stoved hammered gold, or grey blue. Or other voltages to order. Chassis

Attractive cover with chromium carrying handles now available at 17/6.

Full advantage has been taken of the latest component miniaturization developments to reduce unit size to a minimum.

Two high impedance input sockets are provided for microphone and gram., etc. Each input has its associated vol. control.

B.V.A. valves are employed, ECC83, ECC83, EL84, EL84, EZ81.

ALL TEST FIGURES INCLUDE PRE-AMP

FREQUENCY RESPONSE.
±2 d.b. 30-20,000 c.p.s

MAXIMUM POWER OUTPUT.
In excess of 14 watts.

RATED OUTPUT 10 WATTS.

SENSITIVITY.
Vol. (1) 22 millivolts for rated output.
Vol (2) 220 millivolts for rated output.

TREBLE LIFT CONTROL.
Continuously variable +6 d.b. to −13 d.b. at 12,000 c.p.s.

BASS CONTROL.
Continuously variable +13 d.b. to −18 d.b. at 50 c.p.s.

HARMONIC DISTORTION.
0.19% measured at 6 watts

HUM LEVEL.
Referred to maximum output −60 d.b.

NEGATIVE FEEDBACK.
Total 32 d.b.

H.T. and L.T. Supply Point is included for a radio tuner

ALSO AVAILABLE:

The L45. A compact High Quality 4-5 watt amplifier.

Size approx. 6-5-5½in. high. Sensitivity is 28 millivolts so that the input socket can be used for either microphone or gram., tape, radio tuner, etc. B.V.A. valves used are ECC83, EL84, EZ90. Controls are: Vol., Treble and Bass with mains switch. The Tone controls provide full compensation for long playing records. Output matching for 3 ohm loudspeaker.

Retail price **£5/19/6.**

THE LT45 TAPE DECK AMPLIFIER. A complete unit (power pack and oscillator incorporated) ready for connection to A.C. mains. 3 ohm loudspeaker and practically any make of deck. Negative feedback equalization adjustment by multi-position switch for 3¾, 7½ and 15in. per sec.

Retail price **12 gns.**

THE LG3 GRAM AMPLIFIER. Overall size 6½ x 4½ x 2½in. Controls: Vol. and Tone (with mains switch). Output for 2-3 ohm loudspeaker. All above for 200-250 v. 50 c.p.s. A.C mains

Retail price **55/9.**

Send S.A.E. for Leaflets. **TRADE AND EXPORT ENQUIRIES TO—**

LINEAR PRODUCTS LTD.

ELECTRON WORKS, Tel. Leeds 23116 (3 lines).
(Off Upper Town St.) Armley, Leeds

Can't make up your mind which Tape recorder?

You are cordially invited to visit our STAND No. EC53 at the Audio Fair—April 18th — 21st (Waldorf Hotel, W.C.2) to see and hear our very latest models.

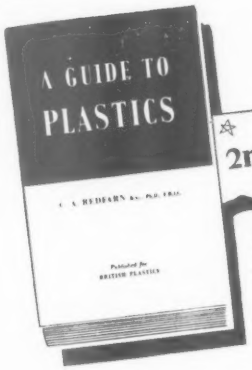
Pound for pound, you get more with a SONOMAG. More fidelity, more flexibility (3 speeds), more performance. The latest Collaro deck, with 3-digit rev. counter is standard. And both portables (see the new Continental-styled model) and the Adaptatape are designed to operate in circuit with your Hi-Fi amplifier and speakers. Hear them all, count the cost and you'll decide on SONOMAG.

PORTABLE 52 gns.
ADAPTATAPE 38 gns.

Write for full details now to:

SONOMAG LIMITED

2, ST. MICHAEL'S RD., STOCKWELL, LONDON, S.W.9
Telephone: BRIXTON 5441 (3 Lines)



explains what plastics are and how plastics goods are made

A GUIDE TO PLASTICS

by C. A. Redfarn, B.Sc., Ph.D., F.R.I.C.

This book by a well-known expert, explaining what plastics are and how plastics goods are made, has been brought completely up to date. Specially devised colour charts show all the stages in plastics manufacture from raw materials to finished goods. For students, for those already engaged in the industry, and for all who desire to learn more about the commercial development of plastics.

18s. net *by post 19s. 2d.*

from leading booksellers

Published for "British Plastics" by
Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES." Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., C. & G. (Electrical, etc.), General Cert., etc., on

144 PAGES Free!

"NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto, Aero, Radio, etc., Building etc. If you're earning less than £16 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE

B.I.E.T.
387 College House, 29-1, Wright's Lane, London, W.8.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

SHERWOOD INSTRUMENTS LIMITED

FOR GUARANTEED WORKMANSHIP WITH PERSONAL SERVICE

- CAPSTAN WORK 10BA TO 1¼in.
- SHEETMETAL FABRICATIONS
- ELECTRONIC METALWORK
- PRESSWORK—ASSEMBLIES
- PRODUCTION MACHINING
- DRILLING—TAPPING—MILLING
- WELDING—SILVER SOLDERING

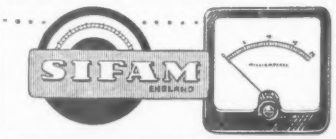
A.I.D. APPROVED

ROSEMONT ROAD, LONDON N.W.3
HAMPSTEAD 6655.

"ALL your TV Components from One Source"

direct TV Replacements

BONA FIDE TRADE ONLY
Non-Trade Clients — see your dealer NOW!
138 LEWISHAM WAY, NEW CROSS, S.E.14
TIDeway 6666 *Grams: Flibak, London, S.E.14*



SIFAM ELECTRICAL INSTRUMENT CO. LTD.
LEIGH COURT - TORQUAY - Telephone 4547/8

PULLIN

SERIES 100
HIGH RESISTANCE
TEST METER
AC/DC 10,000 ohms/volt
21 RANGES
100 microamps to 1000 v.
Complete in die-cast case with test leads, clips & prods

CASH PRICE **FULLY GUARANTEED**
£12-7-6 or Deposit £2-10-0 & nine further monthly payments of £1-4-6.
illustrated brochure free on request.

FRITH RADIOCRAFT LTD
69-71 CHURCH GATE LEICESTER
& 38 HIGH ST NEWPORT PAGNELL Bucks

CABINETS

for
Goodmans, G.E.C., Wharfedale, Jensen

STANDARD BASS REFLEX CABINETS
Walnut, Mahogany and Oak, as illustrated (34" high)
12" Speaker Model **£10.0.0**
10" Speaker Model **£9.10.0**
8" Speaker Model **£9.0.0**
Open till 5.30 Saturdays.

A. DAVIES & CO. (Cabinet Makers)
3 Parkhill Place, off Parkhill Road, London N.W.3. GULLIVER 5775

TRANSFORMERS for MULLARD 510 AMPLIFIER

Fully Shrouded Upright Mounting. Fully Guaranteed, interleaved and impregnated. T.56 300-0-300 v. 100mA., 6.3 v. 2 a. ct., 6.3 v. 1 a. **27/-**. P/P 2/6. T55 for 510 Amp. and Tuner 300-0-300 v. 120 mA., 6.3 v. 2.5 a. ct., 6.3 v. 2.5 a. ct., 6.3 v. 1 a. **32/-**. P/P 2/6. Primaries for above 240-220-200; 0-10 v. 50 c/s. T44 Ultra-Linear Output Transformer 8,000 ohm. with 43% tappings for 510 Amp. **30/-**. P/P 2/-.
SPECIAL OFFER T44 and T55 **59/-**. P/P 3/6.
All carefully made to conform to specifications.
SOUTHERN TECHNICAL SUPPLIES
13 NORTH STREET, PORTSLADE, SUSSEX
Tel.: HOVE 47223

The world's biggest display of equipment for saving...*TIME...COST...EFFORT*...in industry

THE INTERNATIONAL

MECHANICAL HANDLING EXHIBITION

AND MATERIALS HANDLING CONVENTION

Earls Court, London, 7-17 MAY, 1958

Mechanical handling is today's vital factor in industrial cost reduction.

What are the latest advances in this field? What devices and methods are available to cut costs by speeding and smoothing the flow of materials and finished products in factory and warehouse?

The 1958 Mechanical Handling Exhibition holds the answers. At Earls Court, 7-17 May, you will see the biggest display ever staged of equipment and techniques to save time, space and effort. Here is your opportunity to discuss with experts new ways of achieving higher output for less cost in large and small organisations. This is the year's outstanding industrial event! Post the enquiry form for details and season ticket.

* Half a million square feet of space, showing every type of equipment, from hand trucks to complete factory installations.
* Convention where experts from many countries will explain their methods of speeding production.
* Something to save time, cost and effort in every industry from bottling to building.
* Free consulting bureau and industrial cinema during exhibition hours (10 to 6).

ORGANIZED BY 'MECHANICAL HANDLING'—AN ILIFFE JOURNAL

AN EXHIBITION full of interest for all concerned with production

MAIL THIS FORM TODAY for descriptive brochure and free season ticket

To MECHANICAL HANDLING · DORSET HOUSE · STAMFORD STREET · LONDON · S.E.1

Please send 1958 Exhibition Brochure, free season ticket, etc.

NAME_____

ADDRESS _____

_____

648

THE WORLD'S GREATEST BOOKSHOP

FOYLES

★★ FOR BOOKS ★★

FOR ALL YOUR

Technical Books

'Foyles is an experience—the largest bookstore on earth. If you're a lover of books, large or small, modern or rare, here's Paradise'

—*Fielding's Guide to Europe*

119-125 CHARING CROSS ROAD, LONDON, W.C.2

Gerrard 5660 (20 lines) ★ *Open 9-6 (Thurs. 9-7)*

Nearest Station : Tottenham Court Road

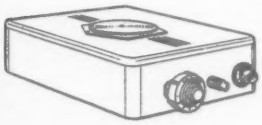
TECHNICAL AUTHORS

MWT are required by Marconi's of Chelmsford to assist in the preparation of radio and radar equipment handbooks. Applicants should have a good working knowledge of such apparatus together with ability to write in a clear and concise manner.

These appointments would be suitable for ex-Service personnel with operating or maintenance experience of wireless or radar equipment.

Posts are permanent and pensionable. Five-day week. Canteen facilities.

Apply, giving full details and quoting reference WW 2036C, to Mr. J. L. Scott, Department C.P.S., Marconi House, 336/7, Strand, London, W.C.2.



"Reco Special" 3-transistor portable receives home and continental stations. Uses specially designed high gain frame aerial, mounted on metal chassis. Months of operation from 3-volt battery. Complete kit with balanced armature reproducer and attractive plastic case. Only 65/- including battery.

"The Reco" 2-transistor portable receives home and continental stations, uses high gain ferrite rod aerial. Complete kit with balanced armature reproducer and neat plastic pocket case, 4½ × 4½ × 1½. Only 55/- including battery. Wiring circuit diagram parts list for above 2/- P.O.

RADIO EXCHANGE CO.

27 HARPER STREET, BEDFORD

TEST ENGINEERS

Vacancies exist for experienced Engineers. Applications are invited from Test Engineers with previous industrial experience of testing Radio Communication or similar electronic equipment. The work of the Test Laboratory of this expanding Company is varied and includes the testing to specification of prototype and small batch production of the following types of equipment:—

(a) Communication and Broadcast Transmitters (50 W. to 10 kW.)
(b) Communication Receivers.
(c) Marine Installations including Automatic Alarms and D.F. equipment.
(d) Industrial R.F. Heaters up to 125 kW.
(e) Audio Amplifiers (2 W.—2 kW.)

The positions are permanent and progressive and the salaries offered will be commensurate with qualifications and experience. Apply giving full details to Personnal Officer, REDIFON LTD., Broomhill Road, S.W.18.

CHANGE OF ADDRESS

GRIFFITHS HANSEN (*RECORDINGS*) **LTD.**

London's Leading Agents for **VORTEXION** *Tape Recording Equipment etc., have now moved their* **RECORDING STUDIO, SALES AND HIRE** *Department to :—*

24/25 FOLEY STREET, LONDON, W.1.

MUSeum 2771/6375.

LOCKWOOD

makers of

Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY (WOODWORKERS) LTD.

Lowlands Rd., Harrow, Middlesex. Byron 3704

FERRANTI LIMITED, EDINBURGH

invite applications for the following Staff appointments in their Trials Division:

1. **FIELD TRIAL ENGINEERS** to join a small team that will be engaged in field evaluation trials of an experimental CW radar installation.

2. **FIELD TRIAL ENGINEERS** to join a team engaged in the field trials of experimental airborne radar and fire control systems.

3. **LIAISON ENGINEER** to assist in the introduction of fire control systems to aircraft manufacturers and the services.

For posts 1 and 2 applicants should possess Higher National Certificate in Electrical or Electronic Engineering or suitable equivalent and have had at least 3 years' experience in radar systems.

For post 3 applicants should possess a Higher National Certificate or equivalent and have had at least 3 years' experience in gyro instruments and electronics. A junior Naval or Air Force Technical Officer might suit. Although primarily based at Edinburgh these posts will require applicants to travel within the United Kingdom.

Please send full particulars of experience and qualifications to the

Personnel Officer, Ferranti Limited,

Ferry Road, Edinburgh, 5, quoting Ref. TID/59

FM and HI-FI COMPONENTS

in stock for the

WIRELESS WORLD FM TUNER UNIT

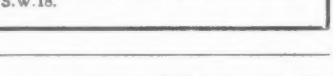
DENCO FM TUNER	circuits	1s. 6d.
RADIO CONSTRUCTOR FM	"	2s 0d.
MULLARD AMPLIFIERS	"	3s. 6d.
G.E.C. 912 PLUS AMPLIFIERS	"	4s. 0d.
G.E.C. FM PLUS TUNER	"	2s. 6d.

A special price list on request to

J. T. FILMER 82, DARTFORD ROAD, DARTFORD, KENT.

(a few minutes from Dartford Tunnel)

TELETRON SUPER INDUCTOR COILS



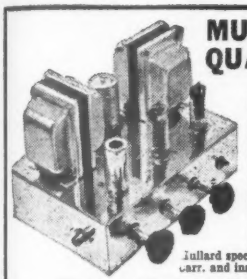
Ferrite Rod Aerials. Wound on high permeability Ferroxcube rod. Medium wave 8/9. Dual wave 12/9.

Type HAX. Selective crystal diode coil for tape and quality amplifiers. MW 3/-. LW 3/6. Dual wave TRF Coils matched pairs (as illustrated) 7/- pair. Type S.S.O. Supersonic Tape Osc. coil, provides 6.3 v. 3 a. RF for pre-amp heater. Eliminates induced 50 c/s hum, 40/100 kc. 15/- ea. Transistor coils, etc. Available from leading stockists. Stamp for complete data and circuits.

THE TELETRON CO. LTD.,

266, Nightingale Rd., London, N.9. How 2527

MULLARD "3—3" QUALITY AMPLIFIER



An ideal companion unit to the JASON Tuner. A really first-class 3-valve 3-watt Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line-up: EF86, EL84, EZ80. Hi/duty mains trans. giving extra HT and LT for Tuner Unit addition.

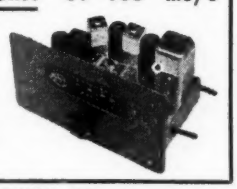
Variable treble cut and bass boost controls, sensitivity 100 MV for 3-watt output. Frequency response + or − 1db, 40 c/s to 25 kc/s.

Complete amplifier wired and tested with quality sectionalised output transformer to Mullard specification (less speaker) carr. and ins. 4/6. **£8.8.0**

Wired Power O/Put Socket with Additional Smoothing 10/6 extra.

JASON F.M. TUNER UNIT 87-105 mc/s

F.M. TUNER-UNIT (87 mc/s—105 mc/s) by Jason. As described in Radio Constructor. Designer-Approved Kit of parts to build this modern highly successful unit, drilled chassis and superior type dial as illustrated. Coils, cans and all quality components, etc. for only 5 gns., post free. Set of 4 spec. EF91 or equiv valves 30/-, post free. Illustrated handbook with full details. 2/-, post free. **Free with Kit** 48-hr. Alignment Service 7/6 and 2/- p. & p.



ELECTROLYTICS ALL TYPES NEW STOCK

TUBULAR		CAN TYPES	
25/25v., 50 12v.	1/9	8+8/450 v. ..	4/6
50/50v. 4/500v.	2/-	8+16/450 v.	5/-
100/350 v.	1/9	8+16/500 v.	5/6
8/450 v.	2/3	16+16/450 v.	5/6
8/500 v.	2/9	16+16+8/350v.	5/6
8+8/500 v. ..	4/6	32+32/350 v.	5/6
8+16/450 v. ..	5/-	32+32/275 v.	4/6
16/450 v.	3/6	50+50/350 v.	6/6
16+16/450 v.	5/6	60/350 v. ..	6/6
32/350 v.	4/-	80+250/275v.	12/6
32/500 v.	5/-	64+120/275v.	11/6
32+32/350 v.	5/6	100+200/275v	12/6
32+32/450 v.	6/6	100/270 v. ..	6/6

MIDGET TRANSISTOR TYPES. 2μ, 4μF, 6μF, 6V, 3/6; 6μF, 10μF, 16μF 3V., 3/6; 22μF, 1½V. 3/6.

CONDENSERS.—Mica, Silver Mica. All pref. values. 3 pf. to 1,000 pf., 6d. each. Ditto ceramics 9d. each. Tubulars 450 v. Hunts and T.C.C. .001 mfd.-.01 and .1/.25 v., 9d. each. .02-.1/500 v. 1/- each. .25 Hunts, 1/6. .5 Hunts, 1/9. .001 mfd. 6kv., 5/6. .001 mfd. 20kv., 9/6.

CLOSE TOLERANCE CONDENSERS 5/Mica. 10% Type, 5pf.—500 pf., each 1/-; 600 pf.—5,000 pf., each 1/3. 1% Type, 1.5 pf.—50 μf. (Tot. 1 pf.), 1/9; 56 pf.—500 pf., each 1/9; 575 pf.—5,000 pf., each 2/-.

RESISTORS.—Pref. vals. 10 ohms 10M ohms.

CARBON		WIRE-WOUND	
20% Type, ½ w., 3d.; 1 w., 5d.; 1 w., 6d.; 2 w., 9d.		5 w. 25 ohms—10,000 ohms	1/3
10% Type, ½ w., 9d.		10 w. 10,000 ohms	1/6
5% Type, ½ w., 1/-; 1% Hi-Stab., ½w. 2/-		15 w. ohms	2/-
		5 w. 15,000—33,000 ohms	1/9
WIRE-WOUND POTS		10 w.	2/3

Pre-set Min. T.V. Type Knurled Slotted Knob. All values 25 ohms to 30 K., 3/- ea. 50 K. 4/-. Ditto, Carbon Track, 50 K., to 2 Meg., 3/-.

3 w. LAB. COLVERN, etc. Standard Size Pots 2½in. Spindle. High Grade. All Values. 100 ohms to 50 K., 5/6; 100 K., 6/6. **W/W EXT. SPEAKER CONTROL,** 10Ω, 3/-.

SCOTCH BOY, EMITAPE, etc., 1,200ft., 27/-. Long playing, 1,800ft. reels, 45/-. Reels only, 3in. 3/-. 5in. 3/6. 7in. 4/3.

SENTERCEL RECTIFIERS. E.H.T. Type Fly-Back Voltages. K3/25 2 kV., 5/-; K3/40 3.2 kV. 6/9; K3/45 3.6 kV., 7/3; K3/50 4 kV., 7/9; K3/100 8 kV. 13/6, etc. **MAINS TYPES.**—RM1 125 v. 60 mA., 4/9; RM2 135 v. 100 mA. 5/6; RM3 135 v. 120 mA., 7/6; RM4 250 v. 250 mA., 16/-; RM4B type 270 mA., 17/6; RM5 250 v. 300 mA., 21/-.

SPEAKER FRET.—Expanded Bronze anodised metal 8×8in., 2/3; 12×8in. 3/-; 12×12in., 4/6; 12×16in., 6/-; 24×12in., 9/-, etc. Any preferred size cut.

TYGAN FRET (Murphy pattern). 12×12in. 2/-; 12×18in. 3/-; 12×24in. 4/- etc.

NEW BOXED VALVES ALL GUARANTEED

1R5, 1T4 7/6	EABC80 9/6	EZ80	8/6
185, 184 7/6	EB91 6/6	MU14	9/6
384 3V4 8/-	EBC41 9/6	PCC84	10/6
5Y4	9/6	ECC83 10/6	PCF80 10/6
6AT6	8/6	ECC84 12/6	PCF82 10/6
6K7	6/6	ECF80 12/6	PCL83 12/6
6K8	8/6	ECF82 12/6	PL82 10/-
6Q7	8/6	ECH42 10/6	PL83 11/6
6SN7	8/6	ECH81 10/6	PY80 9/6
6V6	7/6	ECL80 10/6	PY81 9/6
6X4	7/6	EF41 10/6	PY82 8/6
6X5	7/6	EF80 10/6	PY83 10/6
7C5	9/-	EF86 12/6	U22 8/6
7Y4	8/6	EF91 8/6	UBC41 9/6
DAF96	9/-	EM85 11/6	UCH42 10/6
DF96	9/-	EL41 10/6	UF41 10/-
DK96	9/-	EL84 11/6	UL41 10/6
DL96	9/-	EY51 10/6	UY41 8/6
35L6	10/6	EZ40 8/6	

SPECIAL PRICE PER SET
1R5. 1T4. 185. 184 or 384 or 3V4 27/6
DK96, DF96, DAF96, DL96 .... 35/-
6K8. 6K7, 6Q7, 6V6, 5Z4 or 6X5.. 35/-

TRANSISTORS. Mfrs. surplus PNP Junction type. **Audio Type** 800 kc/s 230 mW 9/6; **R.F. and L.O. Mixer Type,** 2.5 Mc/s. 19/6. All tested and guaranteed.

Vol. Controls Log. ratios, 10,000 ohms—2 Megohms. Long spindles, 1 yr. guarantee. Midget Edswan type. No. Sw. 3/-; S.P. Sw., 4/-. D.P. Sw., 4/9. Linear Ratio, 10,000 ohms—2Meg ohms. Less switch, 3/- each. **Coax plugs** 1/2. **Coax sockets,** 1/-. **Couplers** 1/3. **Outlet boxes,** 4/6.

80Ω ohm CABLE COAX STANDARD ¼in. diam. Polythene insulated GRADE "A" ONLY.

8d. yd.

SPECIAL—Semi-air spaced polythene. 80 ohms **Coax.** ¼in. dia. Standard core Losses cut 50% IDEAL BAND 3. **9d. yd.**

TRIMMERS. Ceramic, 4 pf.—70 pf., 9d.; 100 pf. 150 pf., 1/3; 250 pf., 1/6; 600 pf., 1/9. **PHILIPS** Beehive Type—2 to 8 pf. or 3 to 30 pf., 1/- each.

LOUDSPEAKERS.—P.M. 3 ohms, 2½in. Elac. 17/6; 3½in. Goodmans 10/6; 5in. Rola 16/6; 6in. Elac. 18/6; 7×4in. Goodmans Elliptical 15/6; 8in. Rola 20/-; 10in. R. and A., 25/-; 10in. WB-HF1012, 99/9; 12in. Plessey 15 ohm with 6×4in. Tweeter and Cross Over Filter, 97/6.

TRS RADIO COMPONENT SPECIALISTS

TRS

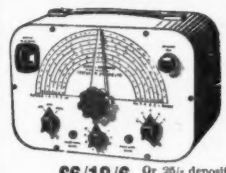
70 BRIGSTOCK RD., THORNTON HEATH, SURREY

Phone: THO 2188. Hours 9 a.m.—6 p.m. 1 p.m. Wed. Open all day Saturday. By THORNTON HEATH STATION.

TRANSFORMER & CO'L W'ND'NG CAPACITY AVAILABLE FOR PROTOTYPES & SMALL RUNS

Terms C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc., payable to T.R.S. Post and Packing up to 1lb. 7d., 1lb. 1/1, 3lb. 1/6 5lb. 2/-, 10lb. 2/9. Bargain Lists 3d.

SIGNAL GENERATOR

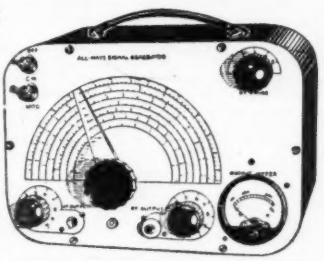


Coverage 150 Kc/s.-100 Mc/s. on fundament.s and 100 Mc/s to 200 Mc/s. on harm nics. Metal case 10in. × 6¼in. × 5¼in. grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F output. Incorporating magic-eye as output indicator. Accuracy plus or minus 2%.

£6/19/6 Or 25/- deposit and 6 monthly payments of 21/6. Post & Packing 5/- extra.

£4/19/6 SIGNAL GENERATOR

Or 25/- deposit and 4 monthly payments 21/6. P. & P. 5/- extra.

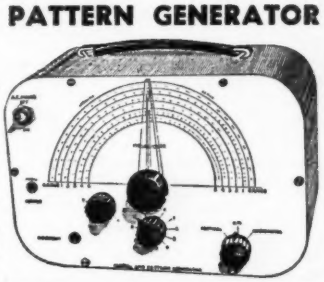


Coverage 120 kc/s.-230 Kc/s. 300 Kc/s.-900 Kc/s. 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s. 8 Mc/s.-28 Mc/s., 16 Mc/s.-50 Mc/s., 24 Mc/s.-84 Mc/s Metal case 10in. × 6¼in. × 4¼in. Size of scale, 6¼in. × 3¼in. 2 valves and rectifier A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuously variable 100 milli-volts C.W. and mod switch variable A.F. output and moving coil output meter. Grey hammer finish case and white panel. Accuracy plus or minus 2%.

SIGNAL & PATTERN GENERATOR

£6/19/6

P. & P. 5/-.



Or 25/- deposit. P. & P. 5/- and 6 monthly payments of 21/6.

Coverage 7.6 Mc/s.-210 Mc/s. in five bands, all on fundamentals, slow motion tuning, audio output for vertical and horizontal bars, logging scale. In grey hammer finished case with carrying handle. Accuracy ± 1%. A.C. mains 200-250 v.

COMPLETELY BUILT PORTABLE AMPLIFIER

Approx. size 6½ × 2½ incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls and double wound mains transformer 230-250 v. ..... **39/6** Plus P. & P. 3/6.

5" P.M. SPEAKER AND O.P. TRANSFORMER if purchased with the above 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

Model 457. 10 records. A.C. mains 200/250 v. Turnover crystal head. BRAND NEW. Fully-guaranteed (suitable for use with above amplifier). 25/- deposit plus P. & P. 5/- and 7 monthly payments of 25/-.

Cash **£8/19/6** Plus P. & P. 5/-.

AC/DC POCKET MULTI-METER KIT

Comprising 2in moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milli-amps. Voltage range A.C., D.C. 0-50, 0-100, 0-250, 0-500. Milli-amps. 0-10 0-100. Ohms range, 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting), toggle switch resistors and meter rectifier. Basic movement 2mA. In grey hammer-finish case.

19/6 Plus P. & P. 1/6. Built and tested 7/6 extra.

Point to point wiring diagram 1/- free with kit.

RADIO AND T.V. COMPONENTS (ACTON) LTD.

23, ACTON HIGH STREET, LONDON, W.3

GOODS NOT DESPATCHED OUTSIDE U.K. ALL ENQUIRIES S.A.E.

Solder with

LITESOL

REGD. TRADE MARK

SOLDERING INSTRUMENTS FOR GREATER SOLDERING EFFICIENCY

● Light weight ● Rapid heating
● High efficiency ● Unbreakable handle ● Bit sizes 3/32in to 3/8in

(In Copper or our long lasting "PERMABIT" or "PERMATIP" types.) All voltage ranges 6/7 v to 230/250 v. 20 models available at prices from 19/6.

British and Foreign Patents. Registered designs. Suppliers to H.M. and Foreign Governments. Agents throughout the world. Write for Booklet No. S.P.5 from sole manufacturers.

LIGHT SOLDERING DEVELOPMENTS LTD.
106, GEORGE ST., CROYDON, SURREY
Tel. : CROydon 8589

LYONS RADIO LTD.

RECEIVERS TYPE R.1155B. One of the best known and most popular of ex-Government communications receivers. This model is fitted with the latest type of improved slow-motion drive. Frequency range 3 to 18 Mc/s. (17 to 100 metres), 75 to 500 kc/s. (600 to 4,000 metres) and 600-1,500 kc/s. (200 to 500 metres), in 4 switched bands. Power requirements are: H.T. approx. 250 v. smoothed D.C. at 60 mA. and L.T. 6.3 v. A.C. at 3.5 A. Supplied with circuit diagram and instruction leaflet. (Contains power pack construction data.) In good condition and working order. PRICE ONLY £8/10/-, carriage 10/-.

ADAPTORS MONITORING, No. 1. The exact purpose of this Unit is not clear to us but they contain many useful components including 8 valves (2—VR78, 4—VR65A, 1—VU120, 1—VU39) and an A.C. Power Pack for 200/250 v. 50 cps. mains input and having an output of: E.H.T.; 1,000 v. smoothed D.C., H.T.; 450 v. smoothed D.C. and L.T. 4 v. A.C. and 4 v. centre tapped A.C. Supplied with circuit diagram of P.P. In condition as new. PRICE ONLY 25/-, carr. 8/6.

SIEMENS HIGH-SPEED RELAYS. Resistance 2,000 ohms, single contact changeover. Ex-Gov., as new. PRICE 9/6. post 9d.

MEGGERS. Ex Gov. In brand new condition, by Eversheds. Wee Megger, 100v. test. PRICE ONLY 85/-, post 3/6. Series 2,500v. test, sealed 0/100 megohms, in leather case. PRICE ONLY £15, post free.

ROTARY CONVERTERS. Input 24 v. D.C. Output 230 v. 50 cps. A.C. at 100 watts. Housed in metal cases 11½ x 10½ x 7½in. In good condition and working order. PRICE ONLY 84/-, carr. 6/6.

3 GOLDHAWK ROAD (Dept. M.W.), SHEPHERD'S BUSH, LONDON, W.12
Telephone: Shepherd's Bush 1729

COPPER WIRE

ENAMELLED, TINNED, LITZ, COTTON AND SILK COVERED. RESISTANCE WIRES, 1 oz., 2 oz., and 4 oz. REELS. All gauges available. B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets. EBONITE and BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES, ALL DIAMETERS. Latest Radio Publications. SEND STAMP FOR LIST. TRADE SUPPLIED.

G.E.C., B.T.H. & WESTINGHOUSE GERMANIUM CRYSTAL DIODES

1/- each. Postage 3d.

Diagrams and three Crystal Set Circuits Free with each diode.
A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

POST RADIO SUPPLIES
33, Bourne Gardens, London, E.4

PROVED

The finest method for cleaning records

Already over 200,000 enthusiastic users

THE "Dust Bug"
AUTOMATIC GRAMOPHONE RECORD CLEANER
PATENT APPLIED FOR

Price reduced to 17/6 (plus 7/- purchase tax)
from your local dealer or
CECIL E. WATTS
Consultant and Engineer (Sound Recording and Reproduction)
Darby House, SUNBURY-on-THAMES, MIDDX

YOUR METER DAMAGED?

Leading Electrical Instrument Repairers to the Industry

Contractors to the Ministry of Supply and General Post Office. Repairs by skilled craftsmen of all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test Meters, Electrical Thermometers, Recording Instruments, etc. Quick deliveries—for speedy estimate send defective instruments by registered post to:—

L. GLASER & CO. LTD.
Electrical Instrument Repairers
97-100 ALDERSGATE STREET, E.C.1
(Tel.: MONarch 6822)

THE "ZEPHYR" (W) 200/250 volts. SHADED POLE MOTOR.

Precision built. 2,600 R.P.M. 25 watts. 2¾in. wide (over fixing lugs). 2¾in. long. Shaft extension ⅜in. Die-cast rotor. Sturdy and SILENT. Ground and polished spindle (5/32in. diam.).
Suitable for Fans, Extractors Fan Heaters, Projector cooling, cupboard airing and all purposes where reliability, silence and freedom from radio and T.V. interference is essential.
Price 37/6 post free (motor only)

ACCESSORIES
Bakelite fan. 8in. diam. 7/6 Metal fan. 4in. diam. 5/-

THE BESTFRIEND ELECTRICAL CO., LTD.
BANSTEAD, SURREY.
F.H.P. motor manufacturers for 30 years.
Quantity enquiries invited.

Wire Wound Resistors

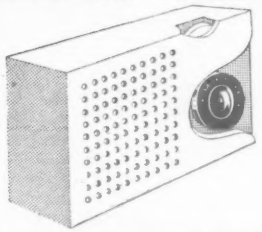
TOLERANCE 1%, 5%, 10%.
RATINGS 6w, 9w, 12w, 20w, 30w.
VALUES 3 ohm - 50,000 ohm
FINISH VITREOUS ENAMELLED
1% ENCAPSULATED
WOUND to your REQUIREMENTS

DELIVERY 7-14 DAYS

AVINASH ELECTRONIC LTD
AVINASH WORKS
70 SILCHESTER ROAD, NORTH KENSINGTON, W.10

LAD 2688

REPANCO MINI-7



The amazing new transistor portable Pocket Radio for the home constructor. The set with all the technical features of a standard receiver. Seven Transistors. Super Het. Circuit. Fully Tunable over Medium Wave. Size 5½"x3½"x2½". Comprehensive Assembly and Wiring Instructions 1/9 (post free).

Mail Order and Trade:
Radio Experimental Products Ltd.,
33 Much Park Street, Coventry

Wholesale and Export:
Repanco Ltd., O'Briens Buildings,
203-269 Foleshill Road, Coventry

FOR PROMPT DELIVERY
WAFER SWITCH
ASSEMBLIES, CUSTOM BUILT

Banks	PAXOLIN	CERAMIC
	s. d.	s. d.
1	7 4	11 10
2	10 9	23 1
3	14 2	34 8
4	17 0	47 5
5	19 9	58 11
6	22 1	71 6
7	24 2	—
8	28 4	—

When A.B. 11 and 12 way Wafers are required, please add 1/- per bank to above prices.
SPECIALS at time and material plus 50%.
● N.S.F. TYPE "G" SWITCHES.

1 Bank	£1 5 2	Control Plate etc., each 15/-
2 Banks	£1 14 7	
3 Banks	£2 4 1	
4 Banks	£2 13 6	Wafers, each 9/-
5 Banks	£3 3 0	
6 Banks	£3 12 5	

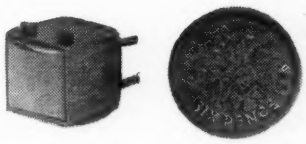
Quotations gladly given for small as well as large quantities, also for special assemblies.

TELE-RADIO (1943) LTD.
189, EDGWARE ROAD, LONDON, W.2.
Paddington 4455/6.

BRADMATIC PRODUCTIONS LTD.....

ANNOUNCE

The "SIMPLEX" SOUND HEAD



Quantity production of the new "Simplex" Record-Playback Head has now commenced. This is a Head of novel design—superior in performance and competitive in price.

Specification capable of amendment to suit most requirements.

ENQUIRIES INVITED FOR QUANTITY QUOTATIONS

Sales Office:— 28 SOHO HILL, B'HAM, 19. *Nor. 8091*
Production Dept.:— 124/6 ALBERT ROAD, B'HAM, 21. *Nor. 6271/2*
Design & Development:— BRADMATIC LTD., WITTON, B'HAM. *East 2881/2*

A.I.D. APPROVED BSL A.R.B. APPROVED

◆ ◆ ◆ THE SIGN OF QUALITY

Radio Makes the World Your Oyster

★ No matter where you are on land, sea or air, the TR-50 MF/HF 50 watt transmitter/receivers (1.5-12 Mc/s) keep you in economical touch with the rest of the world.

As mobile (12 v.) (fixed 110/230 v.) and marine installations they operate in all climates and conditions. They help police forces, petroleum prospecting companies, railway and aeronautical organisations, etc., to maintain reliable radio communication under most adverse conditions.

★ For unattended operation: 100 watt transmitters, mobile and marine (24 v. D.C.). Complete remote control of eight pre-set channels over two ranges 300-600 Kc/s and 1,250-15 Mc/s.

★ Fixed transmitting stations of 250 watts to 5 kilowatts are built by us to suit customers' requirements at most competitive prices. (*See our advertisement on page 187*)

★ Our broadcast range of Hi-Fi transmitters gives you a choice of several models for immediate delivery and installation.

THIS IS A UNIQUE SERVICE

IMMEDIATE ATTENTION—IMMEDIATE DELIVERY—LOW-COST MAINTENANCE AND SPARES FACILITIES—FREE TECHNICAL ADVICE & ASSISTANCE TO OVERSEAS CUSTOMERS

LET US HELP YOU

Agencies can still be offered in some countries

State your requirements to :— THE ENGINEERING DIVISION

BRITISH SAROZAL LIMITED

CONTRACTORS TO COMMONWEATH · COLONIAL AND FOREIGN GOVERNMENTS

SAROZAL HOUSE · 1/3 MARYLEBONE PASSAGE

MARGARET STREET · LONDON, W.1

TELEPHONE: LANGHAM 9351 (3 LINES)

CABLES: SAROZAL LONDON

NEW BOOKS ON RADIO & TELEVISION

The New A.R.R.L. Handbook 1958 32/6
Postage 1/9

Elements of Tape Recorder Circuits, a new American Gernsback Book 23/-
Postage 1/3

High Fidelity Loudspeaker Enclosures by BABANI 5/-
Postage 6d.

Quality Amplifiers Data Book No. II by Radio Constructor. 4/6
Postage 6d.

Radio Control for Model Ships, Boats and Aircraft, by Judd. Post. 9d. 8/6

Radio Valve Data by Wireless World. 5/-
Postage 8d.

F.M. Radio new edition by Sturley. 15/-
Postage 9d.

Television Explained by Miller and Spreadbury. 12/6
Postage 1/3

Television Servicing Vo.. I by Patchett. 5/-
Postage 6d.

A full range of Slide Rules and Drawing Instrument Sets in stock. Send for lists.

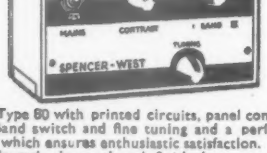
UNIVERSAL BOOK CO.
12 LITTLE NEWPORT STREET, LONDON, W.C.2 (adjoining Lisle Street)

COVENTRY RADIO
COMPONENT SPECIALISTS SINCE 1925

We have now trebled the size of our premises in order to supply a larger range of Components, Amplifiers and HI-FI Equipment.

Send your enquiries to:
189-191, DUNSTABLE ROAD LUTON, BEDS.
New Telephone No. :—LUTON 7388-9

A SPENCER-WEST BAND III CONVERTOR
FOR £6 . 5 . 0



The Type 80 with printed circuits, panel controls or Band switch and fine tuning and a performance which ensures enthusiastic satisfaction. Handsomely designed and finished to stand on your receiver with its self-contained power supply it just plugs straight in

Full descriptive leaflet on request. Available from all good dealers or post free direct from the manufacturers if any difficulty.

SPENCER-WEST LTD.
QUAY WORKS, GREAT YARMOUTH NORFOLK
'Phones: Works 4794; Sales 3009
'Grams. Spencer-West, Gt. Yarmouth

SOLDERING ?

HENLEY SOLON
ELECTRIC SOLDERING IRONS

for 25 years the best

25 watt Instrument Model

A model for every purpose

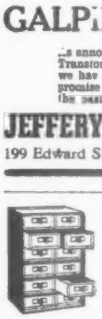
Leaflets on request from:
W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51-53 Hatton Garden, London E.C.1
Tel: CHAncery 6822

Tape Amplifiers for **Wearite, Collaro** and all other Decks, "Miteeamp" 2½ watts 18gns. 6 watts U/L. "Lodestar" 25gns. Transistor tone control preamps, etc., Mixer units, etc. Write,
HARDING ELECTRONICS
120a Mora Road, Cricklewood London, N.W.2
Phone: GLA 1770

GALPINS

...s announced in November we have taken over the Transformer Section of this business. For years we have wound all Galpins transformers and can promise you the same efficiency and quality as in the past.

JEFFERY TRANSFORMER CO.
199 Edward Street, New Cross, London, S.E.14
TIDeway 4458



NEST OF DRAWERS
Overall: 6¼in. wide x 5in. deep x 10½in. high. 12 drawers each 3in. wide x 4½in. deep x 1½in. high. Useful storage for radio components, nuts, bolts and other small parts. Stout sheet steel green enamelled, 20/-. P. & P. 3/-.

HARMSWORTH, TOWNLEY & CO.
2 JORDAN STREET, MANCHESTER 15

SECOND THOUGHTS ON RADIO THEORY
By Cathode Ray of "Wireless World." Forty-four articles reprinted from the popular Wireless World series, in which the author examines various aspects of elementary radio science.
25s. net. By post 26s. 4d.
from booksellers or direct from
Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1

QUARTZ CRYSTAL UNITS

Q.C.C.

Please note change of address :

The QUARTZ CRYSTAL Co. Ltd.
Q.C.C. WORKS,
WELLINGTON CRESCENT,
NEW MALDEN, SURREY.
Telephones: Malden 0334 & 2988
'Grams, Cables: QUARTZCO, NEW MALDEN.

Forrest TRANSFORMERS

are used by B.B.C., I.T.A., Industrial and Research Organisations and Service Departments everywhere.

LISTS ON REQUEST, EXPORT ENQUIRIES INVITED.

FORREST (Transformers) LTD.
349 HASLUCKS GREEN RD., SHIRLEY SOLIHULL, WARWICKSHIRE
Est. 1922 Tel. SHI 2483

TRANSISTOR AMPLIFIER
Type TA2B

Max. Sens'ity 2 Microvolts RMS Audio Range — Tuned or Wide-Band. Noise 3%. Portable.

Write for leaflet A15, or see us at Stand 948. I.E.A. Exhibition Olympia, April 16-25.

MICROWAVE INSTRUMENTS LTD.
NORTH SHIELDS NORTHUMBERLAND

G.E.C.

Applications are invited From

YOUNG MEN under 25

. . . ex-National Service or School-leavers, for one of two different types of sandwich scheme. Both schemes involve full-time University study alternating with varied and interesting practical work under qualified guidance.

This offer is open primarily to potential PHYSICISTS or ELECTRICAL ENGINEERS who prefer a stronger practical bias in what is otherwise the normal B.Sc. degree course. Some candidates will be recommended for the Diploma of Technology course on a Sandwich basis and there may also be vacancies for B.Sc. General students on the day release system.

Apart from a generous salary throughout their training all College tutorial, lecture and examination fees will be paid as well as a book allowance.

Applicants who should have passed at least 3 G.C.E. "A" level subjects (preferably Physics, Pure Maths. and Applied Maths.) should write in detail to:

THE EDUCATION & TRAINING OFFICER, RESEARCH LABORATORIES,

GENERAL ELECTRIC CO. LTD.

North Wembley, Middlesex. *Quoting reference RLL/WW/116*

A COMMUNICATION ENGINEER is required by SHAPE AIR DEFENSE TECHNICAL CENTER

for the implementation and technical acceptance including testing and analysis of a NATO communication system.

Successful applicants should:

(a) have a university degree or equivalent;

(b) have practical experience with HF and VHF equipment;

(c) preferably be between 25 and 40 years of age;

(d) write and speak English fluently.

The basic salaries will be based on the European average for corresponding background and experience.

Applications, containing detailed information on training and past experience should be sent as soon as possible to :

The Director, SADTC, P.O. Box 174, The Hague, The Netherlands.

Electronic Test Assistant

required by

Nelson Research Laboratories, Stafford

for the non-repetitive inspection and testing of electronic and electrical control equipment throughout the laboratories. Applicants should have several years workshops experience and knowledge of electronic circuitry. Please apply with full details to English Electric Co. Ltd., Dept. C.P.S., 335/7 Strand, London, W.C.2, quoting Ref. WW 906G.

Mullard Southampton Works

have a vacancy for a SENIOR ENGINEER to work on the application of semi-conductor devices to the industrial and professional field. Candidates should be educated to the standard of a good Honours Degree in Electrical Engineering or Physics. Experience in the application of semiconductors is not essential but some experience in the application of electronic devices in the fields mentioned would be of advantage.

The Company's general conditions of employment will be found to be attractive and candidates are requested to apply in writing to the

Personnel Officer, Mullard Southampton Works, Millbrook Industrial Estate, Southampton

THE DE HAVILLAND ENGINE COMPANY LIMITED

has vacancies in the Electro-Dynamics Department, at both its Stag Lane, Edgware and Hatfield Establishments for

ELECTRONIC ENGINEERS

Applicants should be of Degree or Higher National Certificate standard, but experience of applied Electronics would be considered of equal importance. The work is concerned with the application of Electronics to problems connected with Gas Turbines and Rocket Motors.

Write (quoting reference SC 756) stating age, qualifications and experience to:

The Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middx.

RADIO TECHNICIANS
IN
CIVIL AVIATION

A number of appointments are available for interesting work providing and maintaining aeronautical telecommunications and electronic navigational aids at aerodromes and radio stations in various parts of the United Kingdom.

Applications are invited from men aged 19 or over who have a fundamental knowledge of radio or radar with some practical experience. Training courses are provided to give familiarity with the types of equipment used.

Salary £600 at age 25 rising to £705. The rates are somewhat lower in the Provinces and for those below age 25. Prospects of permanent pensionable posts.

Opportunities for promotion to Telecommunications Technical Officer are good for those who obtain the O.N.C. in Electrical Engineering or certain City and Guilds Certificates. The maximum salaries of Telecommunications Technical Officers are Grade III £870, Grade II £1,030, Grade I £1,250.

Apply to the Ministry of Transport and Civil Aviation (ESB1/RT), Berkeley Square House, London, W.1, or any Employment Exchange (quoting Order No. Westminster 2109).

Old established and progressive manufacturers of electronic instruments invite applications for the appointment of:

DEVELOPMENT ENGINEER

to work on the design of miniature transistorised electro-acoustic devices.

The Company has a leading position in its fields and its products are marketed throughout the world. The work holds exceptional interest and the position has scope for advancement. The factory is situated in Central London.

Candidates should have O.N.C. or H.N.C. in electrical engineering, electronics or physics or equivalent qualifications, and experience in the design of small electro-acoustic devices. Experience of transistor applications is desirable. Age preferably around 30. Apply stating age and giving full details of education, training and experience and present or last salary to—Box No. 3578 c/o "W. World."

Research Development

Design and Prototype Development of Audio-Electro Devices and Equipment. Box No. 2336 *c/o "W. World"*

THE WAYNE KERR LABORATORIES

require

ELECTRONIC ENGINEERS & DRAUGHTSMEN

for development work in the following fields:

ELECTRO-CHEMICAL AND ELECTRO-MECHANICAL MEASUREMENTS, A.F., V.H.F., U.H.F. AND MICROWAVE MEASUREMENTS, INDUSTRIAL PROCESS CONTROL EQUIPMENT, PULSE TECHNIQUES.

Measurements techniques introduced by The Wayne Kerr Laboratories are finding increasing outlets in a world-wide field of Laboratory and Industrial use.

Attractive and interesting positions offering scope for initiative and ability are available for Senior and Junior Development Engineers and Draughtsmen.

For Senior posts a minimum of Honours Degree Standard or equivalent professional qualifications is required, with several years' experience in the development of electronic instruments. For Junior posts qualifications ranging from O.N.C. to Degree Standard are acceptable. Draughtsmen are required to have experience in the mechanical design of Electronic apparatus.

All appointments are permanent, carry attractive salaries and qualify for membership of the Staff Pension Fund.

Applications, which will be treated in strict confidence, should be addressed to:

The Chief Development Engineer,
Wayne Kerr Laboratories Ltd.,
3, Sycamore Grove, New Malden, Surrey.
Telephone MALden 2202.

THE FAIREY AVIATION COMPANY LIMITED

TECHNICAL ASSISTANTS

required

for the manufacture and servicing of Electronic Equipment used in the measurement of stress and vibration in fixed and rotary wing aircraft at Hayes and at White Waltham Aerodrome. Applicants should be of City & Guilds Radio II standard and have previous experience in servicing electronic equipment. Please apply to the Personnel Manager at Hayes, Middlesex.

DEVELOPMENT ENGINEERS

are urgently required for several new projects commencing immediately. These are concerned with transistorized equipment and ferrite circuitry, but engineers with experience in uniselector and relay work are also required. Initial prospects and salary are attractive. Applications should be sent in complete confidence to The Personnel Manager, Venner Electronics Ltd., Kingston By-Pass, New Malden, Surrey.

TEST ENGINEERS

required for interesting work in connection with Radar, Computers, Machine Tool Control Units, Camera Channels, Microwave Links and similar electronic equipment. Applicants must have sound theoretical knowledge of electronics backed by practical experience in H.M. Forces or Industry. Staff positions and Superannuation Scheme. Single accommodation available. Apply, giving full details to Personnel Department (C.E./21), E.M.I. Ltd., Hayes, Middx.

ELECTRICAL ENGINEERS

An appointment is to be made to a Gyro Research Team of a qualified Electrical Engineer with several years' experience in the design and development of small or miniature electromagnetic components such as synchronous motors, torque motors, and signal generators. Experience in the design of electronic test equipment would be an advantage.

The work will involve using the most modern materials and techniques in the design and development of precision electro-mechanical devices, and their application to miniature gyroscopes and similar instruments.

Please write to the Personnel Manager, (689) ELLIOTT BROTHERS (LONDON), LTD., Borehamwood, Herts.

E.M.I. ELECTRONICS Broadcast Equipment Division have a vacancy for a first-class

SALES ENGINEER

Good prospects exist for the right man who should have experience of television studio equipment, a pleasant manner and an aptitude for hard work. A knowledge of foreign languages would be an added advantage. Please reply giving full details to

Personnel Department (EL/B.48)
E.M.I. Electronics Ltd.,
Blyth Road, Hayes, Middx.

TECHNICAL ASSISTANT GYRO RESEARCH

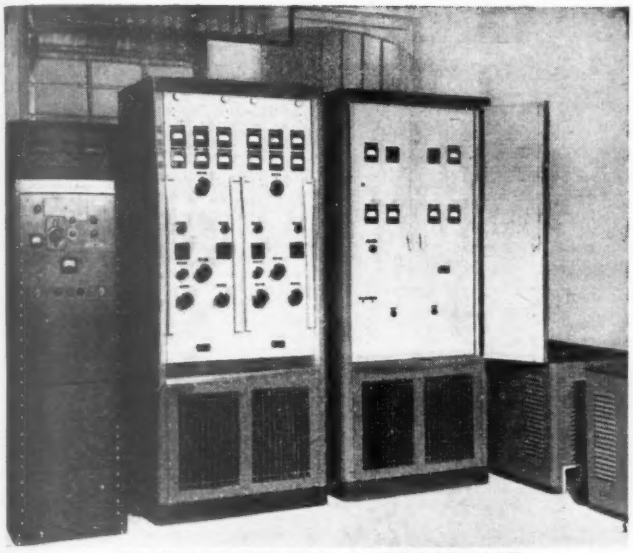
A Technical Assistant is to be appointed with experience in the application of electronic equipment to the development testing of electromagnetic and other devices.

The qualifications required are O.N.C. level or equivalent standard.

Work will include building of test equipment to Engineers requirements and the investigation of problems in the development of electro-mechanical devices.

Please write to the

Personnel Manager (690),
ELLIOTT BROTHERS (London) LTD.,
Borehamwood, Herts.



COMMUNICATIONS | BROADCAST

BRITISH SAROZAL LIMITED

CONTRACTORS TO COMMONWEALTH · COLONIAL AND FOREIGN GOVERNMENTS

SAROZAL HOUSE · 1/3 MARYLEBONE PASSAGE
MARGARET STREET · LONDON · W.1

TELEPHONE: LANGHAM 9351 (3 LINES). CABLES: SAROZAL, LONDON

A NEW 5 Kilowatt H. F. Transmitting Station

COMMUNICATIONS
Model AVT-22-C

A low priced, highest quality ground station radio transmitter (telephone, CW & MCW) designed particularly for point-to-point, aviation, police and other communication services. Multi-channel installations.

Already in operation in all climates and latitudes, the AVT-22-C Models now serve as a vital link in aeronautical radio-telephone communications between Helsinki, Stavanger, Kemi, Oslo and Copenhagen.

BROADCAST
Model AVT-22-D

A low priced, high fidelity broadcast transmitter designed to meet most modern broadcast requirements . . . and meeting them! Overall frequency response of ± 2db between 30 c/s and 15 Kc/s with distortion below 4% (including studio equipment).

Write for details of these and also smaller Communications and Broadcast Transmitters (see our advertisement on page 183) to our ENGINEERING DIVISION.

AGENCIES CAN STILL BE OFFERED IN SOME COUNTRIES

A.I.D. APPROVED BSL A.R.B. APPROVED

THE SIGN OF QUALITY

THE M.O. VALVE COMPANY LTD.,
a subsidiary of The General Electric Co. Ltd., has vacancies for

TECHNICAL ASSISTANTS

for work in a number of fields of development and production of special electronic and gas filled devices.

Candidates should have reached at least O.N.C. or Inter. B.Sc. level, and previous experience is not essential.

These posts offer good opportunities for advancement in a rapidly developing field.

Candidates are invited to apply, quoting L/1 to:
PERSONNEL OFFICER,
THE M.O. VALVE CO. LTD.,
Brook Green, Hammersmith, W.6.
(A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD)

TECHNICAL AUTHORS

MWT are required by Marconi's of Chelmsford to assist in the preparation of radio and radar equipment handbooks. Applicants should have a good working knowledge of such apparatus together with ability to write in a clear and concise manner.

These appointments would be suitable for ex-service personnel with operating or maintenance experience of wireless or radar equipment.

Posts are permanent and pensionable. Five day week. Canteen facilities.

Apply, giving full details and quoting reference **WW 2036B** to **Mr. J. L. Scott, Department C.P.S., Marconi House, 336/7 Strand, London, W.C.2.**

PHYSICISTS AND ELECTRICAL ENGINEERS

Applications are invited from Honours Graduates for special work on the development and manufacture of new electronic and gas discharge devices.

The work will be carried out in close collaboration with the RESEARCH LABORATORIES OF THE GENERAL ELECTRIC CO. LTD.

A number of senior positions are also available.

Candidates are invited to apply quoting R/1 to:—
Personnel Officer,
THE M.O. VALVE CO. LTD.
Brook Green, Hammersmith, London, W.6
(A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD.)

TECHNICAL ASSISTANTS FOR ELECTRONIC WORK

Applications are invited from men with O.N.C. and H.N.C. in electrical engineering and previous experience of development work on electronic equipment, for our analogue computer development laboratories at Whetstone, near Leicester.

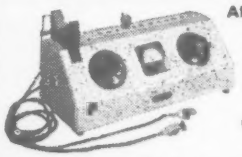
Please apply to Dept. C.P.S., Marconi House, 336/7 Strand, W.C.2 quoting reference WW. 1806A.

ENGLISH ELECTRIC ATOMIC POWER DIVISION

Z & I AERO SERVICES LTD.

14, South Wharf Road, London, W.2

Tel.: AMBassador 0151/2



ARMATURE DROP TESTERS (Ex A.M. Ref. 5G/549)

For testing Motor and Generator Armatures, max. dia. of commutator approx. 4in.; max. overall dia. 7in.; max. length approx. 15in. PRICE £5/10/-. Packing and carriage 15/-.

GENERAL RADIO TYPE 605B "STANDARD" SIGNAL GENERATOR

Range: 9.5 kc/s to 30 mc/s in seven bands.
Accuracy: ±1%. Power supplies 230 v. A.C.
Output: 0.5 μV. to 0.1 V. and constant output of 1 V.
The instrument contains a separator stage which ensures that load variations will not affect the carrier frequency.

PRICE, fully overhauled and guaranteed	£60	0	0
Packing and carriage	£1	10	0

BEAT FREQUENCY OSCILLATORS
MARCONI TYPE 195L, range 0 to 40,000 c/s. Output 2 watts max., accuracy ±1.5%±2 c/s. Otuput impedance 600 and 2,500 ohms Power supplies 200-250 v. A.C.

PRICE, fully overhauled and guaranteed	£65	0	0

B.S.R. LO-50 BEAT FREQUENCY OSCILLATOR. Ranges 0 to 16,000 c/s; two-dial differential tuning; output 0.5 watts.

PRICE fully overhauled and guaranteed	£25	0	0
Packing and carriage	£1	0	0

MARCONI TYPE TF-340 OUTPUT POWER METERS
Meter calibration: 50 mW/17 db F.S.D.
Meter multipliers: 0.1–1.0–10-100.
Impedance values: 25–30–40–50–60–80–100–125–150-200 ohms.
Impedance multipliers: 0.1–1.0–10–100.

PRICE, fully overhauled and guaranteed	£32	10	0
Packing and carriage		15	0

HALLICRAFTER S-27C U.H.F. COMMUNICATION RECEIVERS. Frequency range 130 to 210 mc/s; two RF stages; three IF stages; AM and FM detectors; two audio stages; "S" meter; I.F. 16 mc/s; power supplies 115 V. A.C.

PRICE, fully overhauled and guaranteed	£50	0	0
Packing and carriage	£1	10	0

PETROL ENGINE DRIVEN POWER UNITS

Power unit complete, consisting of 2.3 h.p. single cylinder air cooled petrol engine and 600 watts 115 V. A.C. 400 c/s alternator, mounted on common base and complete with driving belt and spares, brand new	£19	10	0
Packing and carriage	£2	0	0
Engine only	£13	10	0
Packing and carriage	£1	10	0
Alternator only, 600 watts, single phase 115 V. 400 c/s A.C., self-exciting, self-regulating brand new	£2	10	0
Packing and carriage		10	0

INSULATION TESTERS

Record "Minor" 500 V. Insulation Tester, complete with leather case	£10	0	0
Evershed Series I Megger Insulation Tester, 500 volts, 40 megohms	£25	0	0
Evershed Series I Megger Insulation Tester, 1,000 volts, 100 megohms, from	£27	10	0
Evershed Series I Megger Insulation Tester, 1,000 volts, 100 megohms, complete with Decade Box, all brand new	£60	0	0
Evershed Series 2, 500 volt Megger Insulation Tester in leather carrying case	£25	0	0
Evershed Series 3 Megger Insulation Testers, 500 volt (Wee Meggers)	£12	10	0
Evershed Bridge Megger, 500 V.	£45	0	0
Leather cases for Evershed "Wee" Meggers		15	0

All above are fully guaranteed for six months.

MOVING IRON GRADE 1 PORTABLE A.C./D.C. VOLTMETERS, 8in. mirror scale, 160 V. range, unused £5 0 0
Packing and carriage 5 0

T.C.S. COLLINS TRANSMITTING AND RECEIVING EQUIPMENT. Frequency range 1.5 to 12 mc/s, crystal controlled or VFO operation; output 20 W voice or 40 W. C.W. Complete installation consists of: Transmitter, Receiver, Remote Control Unit with built-in Loudspeaker, Antenna Loading Coil, three interconnecting cables; Power Supply Unit for 12 V., 24 V., 115 V. or 230 V. D.C., or 230 V. A.C.: Headphones, Hand Microphone and Key. **These installations are especially suitable for use on board ships, small craft, etc.** Large assortment of spares available Particulars on application.

OUR NEW RETAIL SHOP IS NOW OPEN AT 85, TOTTENHAM COURT ROAD, LONDON, W.1

(open all day Saturday)

Among many other items, the following are available for personal callers:
Please address all correspondence, postal enquiries, Mail Orders (these should include 2/- in £ for packing and carriage) to our Head Office.

EDDYSTONE 358X COMMUNICATION RECEIVERS, 40 kc/s to 31 mc/s, overhauled and aligned, complete with ten coils... £12 10 0
COIL for the above receivers, each 17 6
Per set of 10 in wooden tray... £6 10 0

EDDYSTONE POWER PACK, 175 V. H.T.; 6 V. L.T.; for 200–250 V. Mains.
R-1155A RECEIVERS... £8 10 0

TRANSMITTER-RECEIVERS No. 19 Mk. 2:
Complete with valves ... £2 0 0
Without valves ... £1 0 0

RAY-S U.S. NAVY RECEIVERS, crystal controlled, 25 mc/s range, single channel; contain 24 V. dynamotor and the following valves; one each 12A8GT, 12SJ7, 6AC7 12H6, 12SR7, 12J5: three each 6AB7, two 12SN7GT. PRICE, brand new complete with manual ... £2 5 0

METERS
2½in. Rd. Fl. M.I. 300 V. A.C. ... £1 0 0
2½in Rd. Proj. M.C. 500 mA. ... 8 6
2½in. Rd Proj. Plug-in Type M.C. Centre Zero Plain Scale 600–0–600 μA ... 12 6
Many other types in stock.

SPARE PARTS FOR AVOMETERS, AVOMINORS, AVO VALVE TESTERS, AVO OSCILLATORS AND MEGGERS.
SPARE PARTS FOR AR-88D RECEIVERS.

HEADSETS

CLR Low Impedance		5	6
CHR High Impedance		10	0
DLR Low Impedance Balance Armature		7	6
HS-30/U American Lightweight Headset with Miniature Earplug Type Earpieces		12	6

CARBON HAND MICROPHONES (without switch)... 4 0

I-222-A American Signal Generator, Crystal Controlled, 8–15 and 150–230 mc/s, individually calibrated, for 115 V. A.C. mains £12 10 0

TS-226 RF OUTPUT POWER METER. Power range 1,000 watts max., frequency range 400–425 mc/s. Contains one each valves type 559 6H6GT/T and 6SN7GT and 200 μA. 2½in. meter. Power supplies 115 V. A.C. PRICE, new ... £5 0 0

BC-906D ABSORPTION FREQUENCY METER, range 150–235 mc/s, new ... £2 0 0

BC-1066 TEST RECEIVER, 150–2.5 mc/s. Contains two tuned detector circuits (1D8GT) and two AF amplifiers (957). Power requirements: 3 batteries 45 V. and 1 battery 1.5 V., new... £1 10 0

BC-936 INDICATOR. Contains rectifier 957 to rectify pulsed R.F. Signals. Power requirements: 2 batteries 1.5 V., brand new... 5 0

I-196 SIGNAL GENERATOR. 150–235 mc/s. Contains valve 957 as a self-blocking oscillator tuned by parallel line circuit. Brand new ... £1 0 0

BC-949 RANGE CALIBRATOR. Resonating circuit producing 12, 60 and 120 microsecond pulses. Power supplies 115 V A.C. Brand new ... 15 0

COMPLETE TEST KIT COMPRISING FIVE UNITS DESCRIBED ABOVE, i.e., one each BC-906D, BC-1066, BC-936, I-196 and BC-949, all brand new ... £5 0 0

AVOMETER MODEL 7 CURRENT TRANSFORMER, 400 amps/100 mA., new... £1 2 6

NEW STEP DOWN TRANSFORMERS. 115/230 volts, 2 kVA £5 10 0

LARGE VARIETY OF MAINS, HEATER AND OUTPUT TRANSFORMERS.

LARGE VARIETY OF VALVES. This month's special offer: brand new (not ex equipment) 6H6 metal 1/6 each and 6SJ7 (metal) 5/- each P.P. 3d. per valve.

Please inspect our Self-Service Counter with fixed-price items ranging from 6d to 10/-.

WE BUY HIGH-QUALITY TEST EQUIPMENT, AMERICAN COMMUNICATION RECEIVERS, AIRCRAFT TRANSMITTERS AND RECEIVERS, ETC.

Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional one or part thereof, average lines 6 words. Box Numbers 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day June 1958 issue, Wednesday, April 30th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components and valves which may be offered for sale through our displayed or classified columns carry no manufacturers' guarantee: Many of these items will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such items purchased.

NEW RECEIVERS AND AMPLIFIERS

SHIRLEY LABORATORIES, Ltd., 5, Prospect Place, Worthing, Sussex Tel. 30536. THE TWA/1515 stereosonic tape record.ng and replay amplifier, separate meter monitor.ng on record and playback on both channels, 13watts O/P each channel. 96gns, TWA/15 tape record-ing and reproducing amplifier, 13watts O/P, for Wearite and Collaro decks, 45gns; TW/PA recorcing and replay pre-amplifier, 30gns, both with valve voltmeter monitor.ng; type SB/1-15E high-fide.ity amplifier exceptionally wide tone-control system, 40mv sensitivity, 20gns; with two inputs and 3-position gram filter, 22gns; specia.ized amplifiers for the musical and scientific industries including the Mullard 20watt. [0095

RECO transistor kits are best.—See Radio Exchange advertisement on page 180 or send 2/- for data, circuits and price list to Radio Exchange Co., 27, Harpur St., Bedford. [7669

HI-FI at low cost; our AM/FM R/G chassis and feeders are grand performers at highly competitive prices; we particularly em-phasize our Model A/F834, and 8 valve 3 wave-band 4 watt chassis with gram switching, also Model A/73 AM/FM feeder, trade enquiries invited.—Bayly Bros., 46, Pavilion Drive, Leigh-on-Sea, Essex. [7551

RECEIVERS AND AMPLIFIERS—SURPLUS AND SECONDHAND

HRO Rx's and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R. I. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0055

LOUDSPEAKERS—SURPLUS AND SECONDHAND

G.E.C. metal cone with presence unit in oc-tagonal cabinet, 19gns; 9 cu ft sand-filled corner reflex enclosure, 21gns; pick-ups: Decca XMS78 35/-, Lowther LP with 20TC trans-former 75/-.—Schofield, 8, Silhill Hall Rd., Solihull, Warks. (Sol. 0809.) [7752

TEST EQUIPMENT—SURPLUS AND SECONDHAND

McMURDO SILVER MULTIMETER. Vomax 900.
THIS unusual American instrument, in almost new condition, offers exceptionally wide cover-age.
RESISTANCE: 0.2-2,000 megohms.
DIRECT current: 50 microamps-12 amps.
A.C. volts: 0-3-1,200 in 6 ranges; input 6.6 megohms.
D.C. volts: 0-3-3,000 in 12 ranges; input 51 or 126 megohms.
DECIBELS: —10 to plus 50 db.
BUILT-IN R.F. probe suitable 20 cycles to 100 megacycles; used standard valves; Price £25.—Box No. 4233. [7714

FOR sale, £8 valve-tester. I-177 (Hickok), unused, mint condition.—Bohan, 129a, Gra-ham St., Penrith, Cumberland. [7746

AVO electronic testmeter as new, £-.-.; G.E.C. miniscope, £10.—"Eroica" Sound, 51, Peel St., Eccles, Manchester. Eccles 1624. [0121

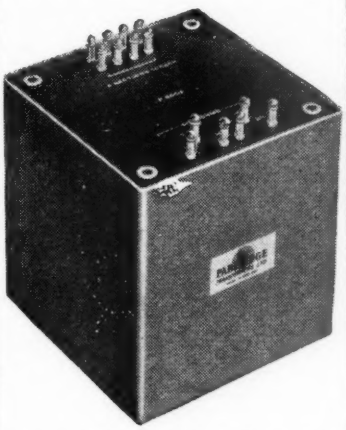
SIGNAL generators, oscilloscopes, output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—Requirements to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986.

NEW COMPONENTS

A BRAND new list for April that will make your eyes pop! Free and post free to dealers; send your bill head; trade and export only sup-plied.—A.W.F., 10, Sackville St., Bradford, 1. [0152

CRYSTAL microphone inserts with excep-tionally high output (Cosmocord Mic. 6), guaranteed new.y made and boxed, 15/6 post free.—Radio-Aids, Ltd., 29, Market Sb., Wat-ford, Herts. [0170

new PARTRIDGE P6000 SERIES



★ A Standard Range of Push-Pull Output Transformers of 100 watt POWER RATING suitable for use in equipment reproducing the full audio-frequency range with lowest distortion.

★ Compound filled, in screened, robust steel cases intended for inverted mounting.

★ Using latest grain orientated cores.

Write now for data sheet giving full information on this new Partridge series.

PARTRIDGE TRANSFORMERS LTD.
Roebuck Road, CHESSINGTON, Surrey
Elmbridge 6737-8

NEW COMPONENTS

UNISELECTORS brand new G.E.C. 3 bank plus homing arc, 25 way, bridging wipers, 12v coil (others available) complete with con-denser and mountings £4 each; Geared motors, Drayton R.Q.H. 200/250 A.C. final speed 8.3 r.p.m. new and boxed £7.5 each.—Hayes, 1, Ceylon Place, Eastbourne. Tel. 293. [7757

COMPONENTS—SURPLUS AND SECONDHAND

AMAZING offer by Waltons of Wolverhamp-ton.
12 DIFFERENT relays of U.S.A. and English manufacture for 37/6 and 2/6 post and packing; large purchase enables us to make this unique offer! Each parcel of 12 includes some or all of the following types: Post Office, miniature, super sensitive, high speed, light and heavy duty, etc., etc.; we cannot select individual types nor repeat once existing stocks are cleared: send now!
WALTONS WIRELESS STORES, 46-48, Staf-ford St., Wolverhampton. [0147

CONSTANT voltage unit, for fluctuating mains, 190v-260v input, 250v 250w output; 85/-, plus carriage.—Box 4601. [7744

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport St., London, W.C.2. See our dis-played advertisement page 170.

ELECTROTEK ENGINEERING, 5, Melbourn St., Royston, Herts, offer the following government surplus items all tested before despatch.
A.F. chokes, tropicalized 4H 75 MA, 2/6 each (postage 2/-); carbon pile voltage regulators, 5U/2175 10/- each (2/-); 4,000 volts con-densers 0.1F, 2/- each (2/-); 12,000 volts condensers, 0.02F, 2/- each (2/-); tubular re-sistors, wire-wound, 10,000 ohms 100 watts, 2/6 each (1/3); plastic knobs, 3in dia (¼in spindles, 1in long), 4 for 2/6 (1/-); coaxial connectors, 8ft long, 2/- each (1/6). [7721

HOW to use ex-Gov. lenses and prisms, H.Nos. 1 and 2 2/6 ea; vertical enlarger plans for 35mm to 2¼sq 3/6 ea; optical condensers and Achromatic lens to suit 35/-; lists, s.a.e.—H. W. English, Rayleigh Rd., Hutton, Essex. [0126

MAGSLIPS at low prices, fully guaranteed. No. 3 in Resolver No. 5 (AP 10861), 50v, 50c/s, unused each in tin, 35/-, post 2.1; large stocks of these and other types.—P. B. Crawshay, 94 Pixmore Way, Letchworth, Herts. Tel. 1851. [0087

ILLUSTRATED Catalogue No. 13 containing over 450 items of Government surplus and model radio control equipment, 2/2, refunded on purchase of goods, 2/6 overseas sea mail.—Arthur Sallis Radio Control, Ltd., Department W.W., 93, North Rd., Brighton. [0193

CATHODE ray tubes, used but in good work-ing order, with 3 months' written guaran-tee; 12in to 17in Mazda, Mullard and equivalent types only at £4/10 each, plus 12/6 for carriage and insurance.—Enquiries and orders to BHP Distributors (London), Ltd., 379, Staines Rd., Hounslow, Middx. Tel. Hou. 5144. Our terms are c.w.o. or c.o.d. [7739

NEW GRAMOPHONE AND SOUND EQUIPMENT

DON'T miss the LP tape sale of Sound News —See under tape recording etc. [0194

TAPE recorders, Ferrograph, Vortexion, Brenell, Telefunken, M.S.S., Truvox, and Reflectograph.
TAPE decks, Wearite, Brenell, Truvox, Dulci Harting, Sonomag Adaptatape (Collaro).
AMPLIFIERS and tuners, Leak, Quad, R.C.A., Dulci, Dynatron; microphones, Reslo, Acos, Philips, Labor, etc
ALL tapes and accessories; audio service dept. and recording studio, hire-purchase facilities available.
LAMBDA RECORD Co., Ltd., 95, Liverpool Rd., Liverpool, 23. Great Crosby 4012. [7749

TANDBERG stereophonic tape recorder now being demonstrated by appointment at Grifhano Studios. (See below.)
FERROGRAPH, Harting and Vortexion tape recorders for sale or hire; may we arrange to demonstrate these superb instruments to you; easy terms available.—"Grifhano" Studios. (See below.)
RECORDING studio available for personal recordings on disc or tape, dubbing ser-vice, mobile recording unit for all functions, etc.—Write or 'phone: Griffiths Hansen (Re-cordings) Ltd., 24-25, Poley St., London, W.1. Mus 2771/6375. [7722

GLASGOW.—Recorders bought, sold, ex-changed, cameras, etc., exchanged for re-corders or vice versa.—Victor Morris, 406, Argyle St., Glasgow, C.2. [0201

CINE-VOX disc recording mechanisms for L.P. or standard operation from 30gns.-56gns.; also complete tape disc or direct chan-nels from 50gns.-112gns.
DEMONSTRATIONS can be arranged in Lon-don.—For full details write to K.T.S., Ltd., "Coplow," Park Rd., Braunton, N. Devon. Callers by appointment only. [0210

HANNEY

offers

Components for

OSRAM 912 PLUS AMPLIFIER
OSRAM 912 PASSIVE UNIT
OSRAM 912 PRE-AMPLIFIER
OSRAM F.M. PLUS TUNER
MULLARD " TAPE " AMPLIFIERS
MULLARD 510 AMPLIFIER

STOP PRESS

COSSOR
3 VALVE, 3 WATT AMPLIFIER KIT
£9-15-0
AS ADVERTISED

Manuals Available:
912 PLUS AMPLIFIER—4/-; OSRAM F.M PLUS TUNER—2/6; MULLARD HIGH QUALITY AMPLIFIER MANUAL (contains F.M. details)—3/6; DENCO F.M. TUNER—1/6.

Send 3d. postage, stating lists required. General Components list also available.

L. F. HANNEY
77, Lower Bristol Road
Bath

● **AERIAL EQUIPMENT.** Poles, Masts, Dipples, Yagi, Microwave arrays. Whips, 12in. Whips to 90ft. Masts.

● **CABINETS AND RACKS.** 36in. to 96in. high, standard 19in. wide.

● **CONDENSERS** up to 10,000 mfd. and 50 kV.

● **FUSES.** Cartridge and E.S. ½ amp. to 600 amps.

● **INSULATORS.** 80 different patterns.

● **LOUDSPEAKERS** 3in. dia. to 50 watt Theatre Systems.

● **METERS.** 2in to 12in. dia. 120 different types.

● **POWER SUPPLIES.** Generators, Rectifiers, Vibrators, Inverters, Dynamotors from 2 volts 100 amps. to 36,000 v. ½ amp.

● **RECEIVERS.** 80 types available from 15 kc/s. to 600 mc/s. including portable, D.F., Table Rack and Pedestal.

● **TEST GEAR,** American, over 100 different types, Meters, Calibrators, Signal Generators, etc.

● **TELEPHONE AND TELEGRAPH EQUIPMENT.** Single- and multi-channel apparatus, filters, switchboards, power supplies, perforators, printers.

● **TRANSFORMERS** Audio and Power, 200 types from 2 volts to 18,000 volts and up to 15 kVA.

● **TRANSMITTERS,** 60 different types from UF-1 Handie Talkie to G-50, 2,500 watts.

FULL LISTS AVAILABLE

Send your requirements. All packing and shipping facilities.

P. HARRIS
ORGANFORD, DORSET
Telephone: LYCHETT MINSTER 212

NEW GRAMOPHONE AND SOUND EQUIPMENT

ALL Hi-Fi and tape recorder fans should send 3d for our list; 1558: we cover practically all your needs.—R.H.S., 155, Swan Arcade, Bradford, 1. [0196

TRANSISTORISED 10w amplifiers for fixed, portable and mobile use, size only 7¼in × 4¼in × 2¼in; complete details from—The Laventa Sound Co., Sales Division, 24, Arden Rd., Birchfields, Birmingham, 6. [7751

TAPE recorders for home and industry: Brenell, 53gns; Ferrograph recorders from 79gns; Leevers-Rich, from £450 according to specification; Standard and L.P. tapes; high quality mics, "Cadenza" Reslo, etc.; speakers, tuners, etc.; tape/disc and complete recording service.—"Eroica" Sound Recording Services (1949), 31, Peel St., Eccles, Manchester. Eccles 1624. Director: Thurlow Smith, A.R.M.C.M. [0122

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

MINIFON pocket wire recorder, with foot controls; £60 o.n.o; seen London.—Box 4580. [7741

VORTEXION Tape Recorder, as new, £95 o.n.o.; new tapes, 1,200ft, 7in reel, 30/-.—Walters, Chemists, 35, Abbey Rd., West Bridgford, Nottingham. [7759

PAMPHONIC rack amplifier, 250-watt output with special 9-valve preamplifier, input 3 mikes, H and L impedance input for pick-up (little used), spare set valves; £120.—Mayes, 22, Phillpotts Ave., Bedford. Tel. 4647 after 7 p.m. [7720

TAPE RECORDING, ETC.

TAPE to disc, Queensway Recording Studios, 123, Queensway, W.2. Bay. 4992. Recorders serviced and for hire. [7421

RENDEZVOUS RECORDS offer comprehensive 78/LP tape to disc recording facilities.—Leaflet from 19, Blackfriars St., Manchester, 3. [7402

BRAND new recording tape, 1,250ft 7in reels, boxed at 16/9 ea.; p. and p. 1/3; money refunded if not satisfied.—A. Marshall, 18, Cricklewood Brdwy., N.W.2. Gla. 0161. [7764

USE Britain's oldest full-time tape/disc transfer service for LPs and Mark 78s (still 1952 rates).—Sound News Productions, 10, Clifford St., London, W.1. Regent 2745. [0192

TAPE to disc recording.—L.P. (30 mins.), 27/6; 78s, 13/6, 48-hour service, s.a.e. leaflet.—Marsh, Little Place, Moss Delph Lane, Aughton, Ormskirk, Lancs. Aug. 3102 [7369

OUR special supply of factory fresh LP tapes also standard 1,200ft from 25/-, has arrived 1,800ft on 7in reels, 37/6; orders in strict rotation: s.a.e.—Sound News, 10, Clifford St., London, W.1. [0193

THE tape recorder specialists offer wonderful bargains in tape, famous British make, 7in 1,200ft at 5¾in 1,200ft (l.p.) 22/6; 5½in 850ft 19/6; 5in 650ft (l.p.) 19/6; 5in 600ft 14/6; each plus p. & p. 1/6; send now only 500 reels available; tape recorders, bought for cash, all makes stocked, no interest terms, free offers, specialised repair service.—E. C. Kingsley & Co. (F) 132, Tottenham Court Rd., London, W.1. Euston 6500. [7707

VALVES

QUANTITY of old type valves obtainable from Woods Radio, 198, Lavender Hill, Clapham Junction, S.W.11, at original prices as marked on boxes; apply to secretary. FC2, 6C5G, W143, KT241, X22, 6A6, EF36, MP/Pen-A, 220TH, X63, EAB1, MKT4 (5- and 7-pin), TP22, 6C6G, EB4, AC/Pen, VP23, 6G5G, EB34, PenA4, VP2, 6L7G, EBC3, KT45, VP2B, DL63, EL2, PenB4, SP2, H63, EL32, Pen4DD, SS210, 6J5G, EL3, PX4, 215SG, L63, EL35, 2P, K40N, D63, EL50 PA20, PM12M, 6H6G, CBL1, PM24A, 210LF, 6N6G, CL4, PT41, HL23DD, 6N7G, CL6, PM24M, PM2HL, 6B8G, EL85, PX25, HL2, KT66, EBF89, AC/SP3, K30K, 6M1, UABC80, AC5/Pen, HL23, 6A7, UF89, AC5/PenDD, TDD2A, ME41, X41, HL42DD, PM2A, 6C6, VP4 (5- and 7-pin), Pen45, LP2, 6D6, VP4A (5-pin), Pen44, TP25, 6F7, W42, 10P14, Pen25, N148, MS-Pen, W143, QP25, 42E, SP4 (5- and 7-pin), 6L34, 220P, 43, MSP4 (5- and 7-pin), 7R7, PM202, 48, AC/SGVM, 7C6, P2, 18, VMS4B, 6BH6, P220A, 78, MS4B, 9BW6, 220-OT, 77, AG/SG, 6BG6G, PM22A, 6SJ7G, DDL4, 6M2, 220B, 7K7, D41, 30P12, K33A, EM1, MH4, DW2, QP22B, EM4, 41MHL, U14, KL35, ECC31, MH41, 1561, KF35, ECC33, AC2/HL, U18/20, KK32, EK2, MHL4, 5Z3, HL1320, EK32, ML4, 1D6, 4D1, DD41, PY31, 83, 10D1, P41, U26, U06, TDD13C, AC/P4, U84, U76, Pen40DD, SP42, 41MPT, U74, PenDD4020, 202STH, 41-MTL, UU7, 7D3, TH2321, EN31, U21, 7D5, 202VPB, X148, 35Z3G, EAF42, 15D1, KT44, U107, 10LD11, FC13, D43, 1D5, EZ41, 15D2, 61-SPT, CY1, 402PenA, SP13, 61-BT, 6Z5, TH233, 8D2, N43, U16, VP133, HL13, AC6/Pen, U35, Pen383, D15,, W729, Pen453DD, 11D5, C1, 1D8GT, C1C, 180B. [7728

SEVEN transmitting triodes for sale; Type 5C21, 450 watt maximum anode dissipation, 40 Mc/s maximum frequency.—M.R.C., Hammersmith Hospital, Ducane Rd., W.12. [7725

THERMOSTATIC SOLDERING IRON

CECO — 70 watt
Instrument size

HEATS UP QUICKLY—1½ mins.—STAYS HOT—but NEVER OVERHEATS—BIT DOES NOT CORRODE OR NEED CLEANING

WEIGHT—4½ ozs.
(Excluding Flex)

ALL PARTS INTERCHANGEABLE

The Thermostat is easily adjusted to suit the grade of solder and keeps the temperature to within 15°C. It incorporates a microswitch giving snap action on-off with minimum electrical interference. Eliminates dry joints and damage to insulation. Element and bit last much longer.

LIST PRICE 85/- each

BRITISH PATENT No. 663214

Available from Manufacturer:—

CARDROSS ENGINEERING CO. LTD.
LEVENFORD WORKS
DUMBARTON
Phone: Dumbarton 655

BENSON'S BETTER BARGAINS

R1155B. Good condition, fully valved; tested, with "N" drive; handbook supplied, **27/10/-** (rail 10/-). **TEST SET 127U** (1058). U.S.A. Micro-wave Frequency Meters; 375-725 mc/s, 3 valves, new, less bats. **27/10/-. CR100**—brand new; power transformers, **30/-**; kit of spares, including 15 valves, **£3. POWER UNIT,** 301: Input 200/250 v. Outputs: 250 v. 75 mA; 24 v. 1 A. D.C. and 6.3 v. 3 A. A.C. New, cased, with plugs, **45/-** (p.p. 3/6). **COMMAND RECEIVERS,** brand new, 6 valves, med. wave (0.52-1.5 mc/s), **97/6;** used **82/6** (post 3/6). Conversion data & circ., to CAR RADIO, **1/6. I.F. STRIP 373,** new, with valves, **42/6. RELAYS,** coaxial, "P/G" 12 v., **10/-;** set 3 plugs, **1/6. RX78,** 2.4/13 mc/s, with 5 valves, 100 kc/s. Xtal. Good cond., **35/-** (p.p. 3/6). **BC1066** VHF Receiver, valves 2/957, 1/1D8GT, new, **15/-** (p. 3/6). **VIBRAPAKS** 6 v. D.C. to 250 v. 80 mA. smoothed, cased, **22/6;** Mallory 12 v. to 230 v. 80 mA., synch., **17/6** (post 3/6). **VIBRATORS,** Mallory G629C 12 v., 4-pin, **7/6. BRAND NEW R.F.26, 25/-** (post 3/-); **RF27,** good cond., **20/-. DYNAMOTORS** (post 3/6): 12 v. to 250 v. 65 mA. and 6.3 v. 2.5 A. **11/6;** 6 v. to 250 v. 80 mA., **12/6.** 11 v. to 200 v. 50 mA. and 13 v. smoothed, filtered, cased, **15/-. METAL RECTIFIERS:** 12 v., ½ A. bridge **2/6;** 270 v. 80 mA., **HW, 5/-;** 240 v. 100 mA., **4/-;** 350 v. 80 mA., **6/-;** 12 v. 4 A. Bridge, **17/6;** 240 v. 30 mA., **3/6;** 1,000 v. 30 mA., **7/6. R1155 S.M. DRIVES** "N" type, new, **10/6. CHOKES, L.P.,** potted, 20H 80 mA., **8/6;** 10H 120 mA., **7/6;** 12H 150 mA., **9/6;** 8H 250 mA., **11/6** (post 2/6). **TEST METERS.** New, 4 × 4 × 2¼in. Read 1.5 and 3 v., 60 mA. and 5kΩ. **12/6. TS347** contains 10 mA. 3½in. meter, res. etc., **8/6. TS350** with 1 mA. 3½in. meter, valve TP25 etc., **30/-. METERS,** contain 2 separate micro-amp movements and 2 neons, new **7/6.** Cross-over needle (L/R), 100 μA each section; good condition. **12/6. MOTORS,** enclosed, 5¼ × 3¼in. dia., D.E. ¼in. spindle, 200/250 v. (A.C./D.C.) Intermittent, **12/6** (post 3/-). **TEST SET 281;** 600/1,200 mc/s. with 50 c. power pack, **£7** (rail 8/6). **R.F. UNIT** with 2/EF91, 3/EF93 motor tuned (R.A.F. Band I), new, modern, **30/-** (p.p. 3/6). **METAL BOX,** 6¼in. cube, with toggle switch and two insulated terminals, new **4/6** (p.p. 3/-). Box 5 × 9 × 4in. with two relays and min. 24 v. geared motor, **12/6** (p.p. 3/6). Box with 6.3 v., 3 A. CT fil trans., 4 panel fuses and 2 toggles, **10/6** (p.p. 3/6). **CONDENSERS,** variable, min. twin-gang, 15, 25 or 50 pf. each 4/-.
LIST AND ENQUIRIES. S.A.E. please! Terms, C.W.O. **Postage extra.** Immediate despatch.

Callers and Post: **W. A. BENSON (W.W.)**
126 Rathbone Road, Liverpool, 15. *SEF 6853*
Callers: **SUPERADIO (W'chapel) LTD.**
116 Whitechapel, Liverpool, 2. *ROY 1130*

MASSICORE SAVAGE

TRANSFORMERS AND CHOKES for the New 400 watt AUDIO AMPLIFIER

G. R. Woodville — Wireless World — November 1957.

Output transformer type 4T35 as used by the author

1,000Ω anode to anode tapped at 40%.

Four secondaries each 25v. total 400 watts.

High Tension Transformer type 5A9-1

Primary 10-0-200-220-240v. 50~

Secondary 700v. 1.2A rectified D C.

Auxiliary Transformer type 5A9-2

Primary 10-0-200-220-240v. 50~

Secondaries 150-0-150v. 20m/A D.C.

6.3v. 20A

2.5v. 10A

2.5v. 5A

2.5v. 5A

Choke type 5A9-3

2 hys. when carrying 1.2A D.C. and 200v. R.M.S. 100~ D.C. resistance 20Ω.

SAVAGE TRANSFORMERS LIMITED DEVIZES, WILTSHIRE Tel: Devizes 932

VALVES WANTED

ALL types of valves British or American, transmitting and receiving; keenest cash prices paid. What have you to offer?—Write or call Lowe Bros., 9a, Diana Place, Euston Rd., N.W.1. [6985

TRANSMITTING EQUIPMENT—

DINGHY transmitter type 3180, new, with V.625, telescopic aerial, size 2in×4½in×1ft 3in, in guaranteed working order; price £1/10 each, c.w.o.—Batey & Co., Poplars, Cowper Rd., Boxmoor, Herts. Telephone Boxmoor 3783. [7763

WANTED, EXCHANGE, ETC.

AUTOMATIC voltage regulators W.1698, Admiralty pattern required.—Box 3616. [7647

WANTED, scrap aircraft plugs; cash by return.—La-Posta, Watchmaker, Camborne, Cornwall. [7651

WANTED.—Cossor Oscilloscope double beam type 339 or equal.—Fyfe Wilson & Co., Ltd., Station Works, Bishop's Stortford. [7713

VALVES (new), tape recorders, test equipment, any quantity.—Stan Willetts, 43, Spon Lane, West Bromwich, Staffs. Tel. Wes. 2332. [7079

WANTED, HRO coils, Rxs., etc., A.R.88s, BS348s, S27s. etc.—Details to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163

A BETTER cash offer for brand new valves, speakers, components, test instruments, etc., that are surplus to your needs.—R. H. S., 155, Swan Arcade, Bradford, 1. [0190

URGENTLY required, scrap platinum wire, contacts etc.; spot cash for any quantity; £24 per oz troy.—The Scientific Metal Co., 50, Old Brompton Rd., London, S.W.7. [7667

URGENTLY wanted, manuals or instruction books, data, etc., on American or British Army, Navy or Air Force radio and electrical equipment.—Harris, 93, Wardour St., W.1. Gerrard 2504. [7508

WANTED, BC610 Hallicrafters, E.T.4336 transmitters, BC312 receivers, BC221 frequency meters and spare parts for all above; best cash prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6. [0079

WANTED, good quality communication RYS tape recorders, test equipment, domestic radios, record players, amplifiers, valves, components, etc., estb. 18 years.—Call, send or 'phone Ger. 4638, Miller's Radio, 38a, Newport Court, Leicester Sq., W.C.2. [7074

PROMPT cash for the purchase of surplus stocks of televisions, tape recorders, radios, amplifiers and domestic electrical appliances of every description; substantial funds available.—Spears, 14, Watling St., Shudehill, Manchester. Blackfriars 1916. Bankers: Midland Bank, Ltd. [0216

WANTED immediately, good condition surplus, including the following—100 headphones type HS-33, 600 plugs type PL68, 50 plugs type 10H/2218, 100 plugs type PL-259, Microswitches 5C/1790, 5C/1791, 5C/2126, 5C/2081, 5C/1975 and 5CW/4638, 50 sockets JK-48, 50 sockets JK-26, 50 plugs PL-291.—Send price to Box 4540. [7736

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specification.
MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed.
F.M. ELECTRICO Co., Ltd., Potters Bldgs., Warser Gate, Nottingham. Est. 1917. Tel. 54898. [0113

USE Jefco coil winder, cheapest machine on the market.—Details, 170, London Rd., Southend-on-Sea. [0174

MAINS transformers, E.H.T.s, chokes, field coils, etc., promptly and efficiently rewound or manufactured to any specification; 12 months' guarantee.
LADBROKE REWIND SERVICE, Ltd., 320a, Harrow Rd., London, N.W.10. Tel. Ladbroke 0914. [0222

WE have in stock 1,000s and 1,000s of service sheets for sale or hire; these are the actual ones used by the trade; please send s.a.e. with enquiries.—M. Foy, 6, Wykebeck Gardens, Leeds, 9. [1208

D. C. BOULTON for repairs to any loudspeaker: specialists on heavy and P.A. types; cone assemblies, field coils, repair accessories; pressure units, microphones; transformers rewound and to specifications; motor rewinds —134, Thornton Rd., Bradford, 1. Tel. 22838. [0171

ARMATURE rewinding service to the trade; vacuums, drills, grinders, hood driers, dental and washing machine motors; vacuum cleaner armatures replaced from stock; 24 hour service; every job guaranteed; all vacuum cleaner parts, bearings, etc. in stock for any make; complete overhauls our speciality.—Regam Electric, Ltd., 39a, Boar Lane, Leeds 1. [7708

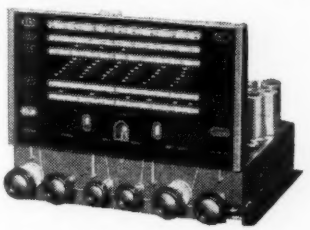
MISCELLANEOUS

CABLE: 10% to 20% under price, full or part coils, cheap fluorescents from 32/9d; catalogues.—B.D.C., 591, Green Lanes, London, N.8. [7710

Armstrong

QUALITY RADIOGRAM CHASSIS

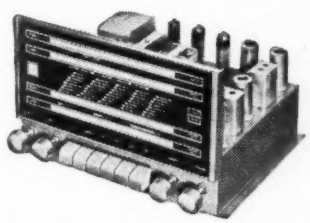
MODEL AF 105 £37



AM and FM Tuners and High Fidelity Amplifier on one compact chassis

- 10 valves. ● 10 watts push-pull amplifier with negative feed-back.
- FM Long, Medium and two Short wavebands.
- Frequency Range: 15-35,000 c.p.s. ± 1 dB.
- Independent and Continuously variable Bass and Treble Controls with visual setting indicators.
- Magic Eye Tuning.

MODEL PB 409 28 GNS



- 9 Valves. ● 6 watts push-pull output.
- Full VHF band (88-108 Mc/s) Plus Long, Medium and Short bands.
- Frequency Response within 2 dB 20-20,000 c.p.s. at 4 watts (double normal room volume).
- Independent Bass and Treble Controls.
- Quick-action "Piano Key" selectors.
- Magic Eye Tuning.

We shall be glad to give you a demonstration of these and other models in our range at our Warlters Road showrooms (open 9-6 p.m. Weekdays and Saturday). If you are unable to visit us please write for descriptive literature mentioning WIRELESS WORLD.

HIRE PURCHASE AND CREDIT facilities are available.

GUARANTEE: All our models are sold under full and unconditional money-back guarantee of satisfaction.

FREE TRIAL IN YOUR OWN HOME. Your money will be returned if *for any reason* you are not satisfied after 7 days' trial.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
Warlters Road, London, N.7
Telephone: NORth 3213

LONDON CENTRAL RADIO STORES

TUFNOL SHEETS 1/16th in. thick.

47½in. × 47½in. per sheet 47/6
23in. × 18in. per sheet 10/-
18in. × 18in. per sheet 7/6

DASHBOARD 8-DAY CLOCKS. Panel mounting, size 2½in. By well known makers. £2/17/6.

VENNER 8-DAY CLOCKWORK TIME SWITCHES. 230 volts, 1 amp., 3½ × 2½ × 2½in., with key and connecting socket. 27/6.

MILLIAMMETERS 0-1, 2½in. dial. Guaranteed in perfect working order. 25/-.

HIGH-SPEED ELECTRO-MAGNETIC COUNTERS. Ex-Govt. 0-9 999, 25/50 v. D.C. Size 4 × 1 × 1in. Single coil. 2,900Ω. 18/6.

METAL RECTIFIERS. Ex-Govt., made by S.T.C., 250 v. 60 m.a. Size 5½in. × 1in. dia. Unused. 7/6.

WIREWOUND RESISTANCES. 160Ω 1 A. Overall size 10 × 1in. dia. Unused. 5/6.

ELECTRO MAGNETIC COUNTERS. Ex-G.P.O., every one perfect, 400 and 500 ohm coil, counting to 9,999, operated from 25 v.-50 v. D.C., 4½in. long × 1½ × 1in., many industrial and domestic applications 5/6.

0-1 MOVING COIL MILLIAMMETER. Overall dia. 3½in., dial 2½in., flush panel mounting. 25/-.

DECIBEL METER. Moving coil, reading −30 to zero (0db = .775 v. (R.M.S.)), overall dia. 4½in., dial 3in. 24/10/-.

MOVING COIL HAND MIKE. Type No. 7. 8/6.

VIBRATORS. Synchronous 6 v. 7-pin and 2 v. 7-pin, 7/6 each.

AVO UNIVERSAL TEST METERS. Reconditioned, as new. In perfect working order. Model 2. £10/10/-.

UNISELECTOR SWITCHES. Have many applications including automatic tuning, circuit selection, etc. Operation on 24-50 v. Half wipe 6-bank. 12/6.

VOLUME CONTROLS with switch, 10K, 2 pole, 1in. spindle. 3/6.

VOLTAGE DROPPING RESISTANCE. 60 watts A.C./D.C., 5 valves, 12 volts, 03 amps, tapped at 100-110 volts, 200-210 volts, 220-230 volts, 240-250 volts. Size 4in. high × 1in. diameter. 5/6.

MILLIAMMETERS. 2in. dial. Reading 30-0-30, flush mounting. Ex-Govt. Not checked for accuracy. 7/6.

HIGH RESISTANCE HEADPHONES. 4,000Ω. 12/6.

LOW RESISTANCE HEADPHONES 600Ω. 7/6.

All prices include carriage.

23 LISLE ST. (GER. 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday

PRECISION SHEET METALWORK

We specialise in manufacturing of Chass's in all meta's, large or small quantities to your own specifications

V. W. BEAMISH

Shardeloes Garage, Shardeloes Rd., New Cross, London, S.E.14.

Telephone: TIDeway 4795

build your own

TAPE RECORDER

with the

'ASPDEN'

tape deck kits

Two models, 5in. or 7in. spools, two speed, twin track, ferroxcube heads, finest motor, and complete assembly instructions.

Compact model 582 kit..... £8 5 0
Standard model 782 kit £9 5 0
Assembled and tested 30/- extra.

And the

RECORD/REPLAY AMPLIFIER KIT, 2½ watt, neon indicator, without valves, £5/18/-.

POWER PACK KIT for above, less valve, £2/18/6.

Carr. extra.

Mr. R. C. K., of Co. Durham, writes:—
"Many people who have heard it have been staggered that such quality can be obtained for such a low price."

This deck and amplifier is being used in the Antarctic by an expedition member.

Send stamp for full particulars to:—

W. S. ASPDEN

Stanley Works, back Clevedon Road, Blackpool, Lancs.

MISCELLANEOUS

METALWORK, all types cabinets, chassis, racks, etc., to your own specification: capacity available for small milling and capstan work up to 1in bar. PHILPOTT'S METAL WORKS, Ltd., Chapman St., Loughborough. [0208

BALL and roller bearings, etc., wanted! also surplus goods, especially hand tools, of all descriptions. For sale: metal boxes of strong and sturdy gauge and construction, with handles, in all sizes: ask for details.—R. Pordes, 138, New Cavendish St., London, W.1. Museum 5250. [7730

VALVE cartons—we can supply from 12 to 100,000 off the shelf; plain white or printed; miniatures 10/-, G.T.s 12/-, G.s 14/- per 100 plus 2/- postage; also printing done to your special requirements; quotations gladly given. —J. & A. Boxmakers, 75a, Goodwin St., Bradford, 1. [0034

AVAILABLE new surplus.—3,000 hand sets No. 2, sound powered, for inter-coms., etc.; 2,000 hand microphones No. 8A; 2,000 pairs double DLR5 headphones; all available at low prices to clear.—Write Pype-Hayes Radio, 606, Kingsbury Rd., Birmingham, 24. Erd. 4942. [7740

NOTICES

BRITISH SOUND RECORDING ASSOCIATION. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality reproduction and other branches of audio engineering, together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Hodgate, A.M.I.E.E., 12, Strongoow Rd., Eltham, S.E.9. [0031

PAINTS, CELLULOSE, ETC.

PANL, recognised for many years as the unique one-coat black crackle finish, brush applied, no baking, available by post in 1/8 pint cans at 5/9 from: G. A. Miller, 255, Nether St., London, N.3. [0260

BUSINESS OPPORTUNITIES

WELL-KNOWN firm of precision engineers and instrument makers (London area) are desirous of entering into a licence agreement or purchasing outright, patents relating to electrical and/or mechanical devices of a precision instrument character, or of a consumer goods nature; adequate capital and production facilities are available to develop, produce and market suitable devices.—Communications should be addressed, in the first instance, to Box 3361. [7589

WORK WANTED

P.T.P.E. SUPPLY, machining, electronic engineering sub-contractors—A. I. D. Bel, Marlborough Yard, N.19. Arc. 5078. [0184

TRANSDUCTORS, magnetic amplifiers and automatic control equipment manufactured to customers' requirements; let us develop and produce the complete equipment for you; moderate charges, prompt service and delivery. —Able Engineering Co., Ltd., 6, Singer St. Chambers, Singer St., London, E.C.2. Tel. Cle. 3695.

SITUATIONS VACANT

RADIO Electricians.

RADIO/ELECTRICIANS familiar with radio and electrical circuits installed in present-day commercial or military aircraft; positions exist Gander, Newfoundland, Canada, with service company handling International Airlines, and successful applicants required to emigrate; transportation expenses paid; salary commensurable with experience.—Submit complete résumé of education and experience to: Maintenance Foreman, Allied Aviation Service Co., Gander, Newfoundland, Canada. [7727

CITY OF BIRMINGHAM Education Committee.
GARRETTS Green Technical College.
GARRETTS Green Lane, Birmingham, 33.
PRINCIPAL: H. C. Whitehouse, B.Sc., A.R.I.C.
APPLICATIONS are invited for the following newly created full-time teaching post in the Department of Electrical Engineering.
LECTURER in electrical engineering required to take up duties as soon as possible; the lecturer will be required to supervise the telecommunications and radio servicing classes in the department, and may be required to teach in the National Certificate course.
APPLICANTS should have graduate or equivalent qualifications, and should have had industrial and teaching experience.
SALARY: £1,200×£30—£1,350. In fixing the commencing salary candidates may be granted increments above the minimum and up to the maximum of this scale in respect of industrial, commercial or professional experience or research work which is approved by the Authority as of equivalent standard to service as a lecturer in an establishment of Further Education.
APPLICATION forms and further particulars available from the Principal (foolscap s.a.e.), to whom completed forms should be returned as soon as possible. [7743

TELEPHONE Mechanic/Engineer, first class, required large firm engineers. 12 months' services overseas; excellent opportunity; write giving experience.—Box 3588. [7638

NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. ONLY Makers' LATEST GOODS supplied NOT Surplus.

S.T. & C. E.H.T. K3/15, 5/-; K3/45, 9/4; K3/50, 9/10; K3/100, 16/8; all post 4d. extra.

BRIDGE CONNECTED FULLWAVE. 17 v. 1 a., 13/4; 1.5 a. 26/6; 3 a., 30/6; 4 a., 38/-; 5 a., 38/6; all post 6d. 33 v. 1 a., 22/9; 1.5 a., 45/-; 3 a. 54/-; 5 a., 68/-; all post 1/6. 54 v. 1 a., 33/-; 1.5 a. 62/-; 2 a. 74/-; 3 a. 74/-; 5 a. 97/-; 72 v. 1 a. 42/-; 1.5 a. 78/-; 2 a. 95/-; 3 a. 95/-; 5 a. 124/-; 100 v. 1 a. 61/-; 1.5 a. 112/-; 2 a. 134/-; 3 a. 134/-; 5 a. 180/-, all post 2/-.

BRIDGE CONNECTED WITH 7⅞in. SQUARE COOLING FINS 17 v. 6 a. 53/7; 10 a. 61/-; post 2/6.

BRIDGE CONNECTED HEAVY DUTY FUNNEL COOLED or 7⅞in. SQUARE COOLING FINS. Both types, same price. 17 v. 20 a. 120/-; 30 a. 172/-; 50 a. 280/-; 33 v. 6 a. 89/-; 10 a. 102/-; 20 a. 202/6; 54 v. 6 a. 124/-; 10 a. 144/-; 72 v. 6 a. 160/-; 10 a. 186/-; 100 v. 6 a 227/6; 10 a. 270/-, all post 3/-.

"WESTALITE" (BRIDGE) 12-15 v. D.C. 0.6 a. 12/-; 1.2 a. 30/-; 2 a. 32/6; 5 a. 37/6; 1.0 a. 64/6; 20 a. 117/6; 30 a. 171/-; 50 a. 278/-; 24 v. 1.2 a. 30/-; 5 a. 60/-; 10 a. 109/6; 20 a. 208/-; 36 v. 1.2 a. 47/6; 5 a. 82/6; 10 a. 154/6; 100 v. 1.2 a. 82/6; 2.5 a. 154/6; 5 a. 195/6; 10 a. 391/-; All post extra 1/6.-3/6. E.H.T. Rects. 14D.134, 25/-; 36 E.H.T. 60 35/10, post 4d. 1 ma. AC/DC meter, rects. 14/6.

"G.E.C." (BRIDGE). 6 and 12 v. D.C. 1 a. 7/6; 1.5-2 a. 8/6; 2.5 a. 11/9; 3 a. 14/9; 4-5 a. 16/6; 6 a. 23/6; 10 a. 34/-; 15 a. 42/-; 24 v. 1 a. 12/6; 1.5 a. 14/3; 2 a. 15/6; 3 a. 26/-; 4 a. 29/6; 6 a. 36/6; 10 a. 75/-; other sizes Under £1 add 1/- over £1 add 1/6 post.

Wholesale and Retail.

T. W. PEARCE

66 Great Percy Street, London, W.C.1

Off Pentonville Road. Between King's Cross and Angel

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE

ROD, BAR, SHEET TUBE STRIP WIRE

3,000 STANDARD STOCK SIZES

No Quantity too Small. List on Application.

H. ROLLET & Co. Ltd.

6 Chesham Place, S.W.1. *SLOane* 3463

ALSO AT LIVERPOOL, BIRMINGHAM, MANCHESTER, LEEDS

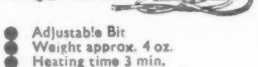
"DIPLOMA" HEADPHONES

Lightweight High Resistance (4,000 ohms). Complete with cord

17/6

Ideal for CRYSTAL SETS

The 'TYANA' Standard Soldering Iron



- Adjustable Bit
- Weight approx. 4 oz.
- Heating time 3 min.
- 40 Watt economy Consumption.
- Standard Voltage Ranges

16/9

Replacement Elements and Bits always available

KENROY LIMITED

152/297 UPPER ST., ISLINGTON, LONDON, N.1

Telephone: CANonbury 4905-4663

CHOKES AND TRANSFORMERS

Special Offer 1
MAINS TRANSFORMER
550-0-550 v., 150-200 mA., 6v. 3 a., 4 v. 3 a., 200-250 v. primary. **30/-**

Special Offer 2
MAINS TRANSFORMER
350-310-0-310-350 v., 220 mA., 6.7 v. 5 a., 6.3 v. 3 a., 6.3 v. 1 a., 5 v. 3 a., 6. v 3 a., 6.3 v. 1a. Potted. **50/-**
CHOKES
10 H., 250 mA., potted " C " core. **25/-**
20 H., 50 mA., potted **20/-**
COMPLETE SET **85/-**

Special Offer 3
MAINS TRANSFORMER
350-0-350-110 mA. 4 v. 2.5 a., C.T., 4 v. 2.3 a., 4.2 v. 6.5 a. Potted, with 110-250 v. primary **20/-**

CHOKES

Gardener, 1 H., 2.5 a. (C.294)	50/-
EMI, 5 H., 200 mA.	4/6
5 H., 100 mA., potted	5/-
5 H., 300 mA , potted	12/6
A.E.E. 5 H. 200 mA.	7/-

ELLISON MAINS TRANSFORMERS

CRT45. Primary 230/250. Secondaries: 2/2.25/2.5/2.75/3 v. at 2 a.	22/-
P20. 250 v., 20 mA., 6.3 v. 1 a.	23/-
FT51. 6.3 v. at 1.5 a (230/240 P)	9/-
LT133. 1/2/4/6/10/15 volts at 4 a., 20/30 v. at 2 a. Up to 15 v. at 4 a. Up to 30 v. at 2 a.	36/6
AT96. Auto 110 v. at 60 watts	24/-
AT92. Auto 110 v. at 100 watts	32/-
MT161. 250-0-250 v., 60 mA., 6.3 v tapped, 5 v. at 2 a., 6.3 v. 2 a.	25/6
MT123. (For Mullard Amp.). 10 0 200, 220, 240 v., P. 300-0-300 at 110 mA. Sec., 6.3 v. 3 a., C.T., 6.3 v. tapped 5 v. 2 a	41/6
MT178. 350-0-350 v. 150 mA. 6.3 v. 5 a., C.T., 5 v 3 a.	52/-
MT235. 430-0-430 v. 200 mA., 6.3 v 5 a., 6.3 v. 3 a., 5 v. 3 a.	85/6
WMT175. (Williamson). 425-0-425 v., 150 mA., 6.3 v. 7 a., 5 v 3 a.	66/-
MT190. 350-0-350 v 120 mA., 6.3 v. 5 a., C.T., 5 v. 3 a.	42/6

● *Complete ranges of Output Transformers including Partridge 500 series available.*

● *We carry exceptionally large and varied stocks of components, accessories and materials for the up-to-date constructor. Lists, etc., on application. (S.A.E., please.)*

TELE-RADIO
(1943) LTD.
189, EDGWARE RD., LONDON, W.2
'Phone: PADdington 4455-6

SITUATIONS VACANT

SOUTHERN TELEVISION, Ltd., will shortly require ENGINEERS and technical staff in all categories covering studio and outside broadcast operations and communications. THE staff will be based at the Southern Television Centre, Southampton. Written applications should be addressed to the Chief Engineer, Southern Television, Ltd., 20, Tudor St., London, E.C.4. [7723

FOREMAN, experienced in the production of small-batch electronic equipment to high standards; state previous experience and salary required; Kilburn area.—Box No. 4203. [7711

SERVICE Engineer, Improver, radio and T.V.; good salary, 44 hour week, private concern; main agencies and modern workshop; permanent employment; clean driving licence.—Offer Radio, Surbiton. [7717

TELEVISION engineer required; modern van available; most main agencies held; progressive opportunities; staff canteen.—Apply Staff Secretary, Bentalls (Ealing), Ltd., The Broadway, Ealing, W.5. [7753

INDOOR and outdoor T.V. engineers required by expanding business; top rates of pay with pleasant working conditions; permanent positions.—Please apply Vincent Television, 139, Peckham Rd., S.E.15. Rod. 2966. [7726

FOREMAN required, fully conversant with all types of transformer manufacture for the radio and electrical industry.—Apply to Haddon Transformers, Ltd., Masons Ave., Wealdstone, Middlesex. [7537

RADIO Relay Service. Experienced engineer required to take charge of amplifier, radio and television maintenance; also wireman with television aerial erection ability; near Derby. —Apply Box 4708. [7756

SENIOR engineers required to work on application of transistors in servomechanisms; ability to make up and evaluate prototypes desirable; salary range £1,000-£1,200; Acton area.—Box 4698. [7761

TELEVISION service engineer, good prospects for keen man in old-established N.W. London retail business; driving experience essential; state age and details of experience. —Box 4655. [7748

PERSONAL assistant required by owner of London retail radio and electrical business of good standing; congenial position and good prospects for capable and conscientious person; state age and details of career.—Box 4654. [7747

SENIOR television engineers required; must be experienced and able if necessary to take charge of work-shop.—Apply for appointment to A. S. White & Sons, Ltd., 130-132, High Rd., South Tottenham, N.15. Sta. 7861-2. [7750

TELEVISION bench and field engineers required at all times for vacancies in most parts of the British Isles; permanent positions with highest salaries, plus bonus for suitable applicants; 5½-day week.—Box 2781. [0251

RADIO mechanics required by company at London Airport, knowledge of aircraft radio an advantage though not essential; good working conditions.—Write Box W.W., 689 LPE, Romano House, 399/401, Strand, London, W.C.2. [7704

THE Research Laboratories of the General Electric Co., Ltd., North Wembley, Middlesex, have several vacancies for technical assistants.—Please apply in writing to the Staff Manager (Ref. RLB 172), giving full details of experience, qualifications and age. [7692

LICENSED aircraft radio mechanics required by company at London Airport in connection with expansion of their premises; good pay and conditions to the right applicants; please write Box W.W., 688 LPE Romano House, 399/401, Strad, London, W.C.2. [7705

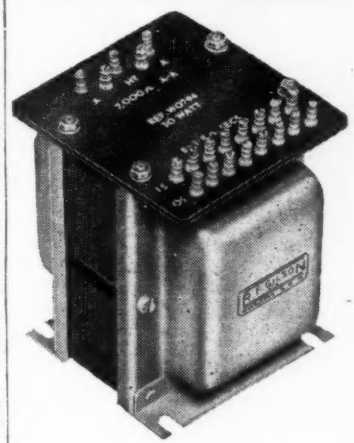
CIRCUIT Development Engineer, domestic radio and television; apply giving details of experience, qualifications and salary required to Chief Engineer, Raymond Electric Ltd., Brent Crescent, London, N.W.10. Tel. Elgar 6687. [7662

ASSISTANT Foreman required for winding shop producing small transformer coils; experience of auto or multi winding machines essential; write initially with full details to: Personnel Officer, Gresham Transformers, Ltd., Twickenham Rd., Hanworth, Middlesex. [7715

AUSTRALIA.—Experienced servicemen in field and depot work required by large television installation and maintenance company; excellent opportunities; single men preferred; advise details of TV service experience; salary £1,100-£1,200 Australian with adequate advancement possibilities.—Apply Box 4522. [7733

ROLLS-ROYCE Limited, Aero engine division, require men for the operation of electronic equipment used in mechanical test work; a knowledge of strain gauge techniques is desirable, possession of Higher National Certificate or City and Guilds Part 1 to 4 in telecommunications would be an advantage. APPLICATION forms may be obtained from the Manager, Technical Administration (DE), Rolls-Royce Limited, Aero Division, P.O. Box 31, Derby. [7709

GILSON
W.O. 866 U.L. OUTPUT TRANSFORMERS



Tests made, using this transformer in the

KT 88
"88/50" 50-WATT AMPLIFIER

produced the results listed below

★ **Less than 1 db below 50 watt over the whole audio range from 30 c/s to 20 Kc/s for less than 1% distortion.**

★ **Only 0.6% distortion at 50 watts 40 c/s.**

★ **Less than 0.1% distortion at 50 watts 500 c/s.**

★ **High frequency resonance above 100 Kc/s.**

Max D.C. in primary 140+140mA D.C. res. 70+70 ohms.

Size only 3¾ x 3¼ x 4¼in high. Weight 5.6lb.

Ruggedly constructed.

Thoroughly tested to ensure uniformity of performance. Absolutely reliable long service.

For **KT88** valves
W.O. 866/597. 50 W., 5,000Ω Primary.

For **KT66 EL34** valves
W.O. 866/97 30 W., 6,600Ω Primary.

For **KT66, EL34,** 4 valves in parallel P-P.
W.O. 866/3397. 60 W., 3,300Ω Primary.

All the above List Price, **£5/12/6** each.

Please write for information leaflets on the above.

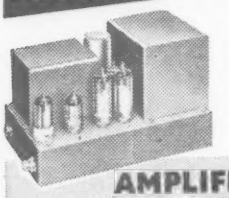
R. F. GILSON LTD. *Phone:* WIM 5695
11a ST. GEORGE'S RD., WIMBLEDON, S.W.19

Makers of HEAVY DUTY MAINS, NEON and FLUORESCENT LIGHTING TRANSFORMERS

The VERDIK QUALITY TEN

10 WATT PUSH-PULL ULTRA LINEAR FEEDBACK

20 GNS COMPLETE



From Your Dealer

AMPLIFIER AND PRE-AMPLIFIER

For details write to

VERDIK SALES LTD.

8 RUPERT COURT, WARDOUR ST. LONDON, W.1. GERrard 8266

METERS

All types
Any make

Single and Multi-range repaired and recalibrated

Meters 2" to 6" supplied from stock.

Scaled to requirements.

E.I.R. INSTRUMENTS LTD.
329 Kilburn Lane, London, W.9
Tel.: LADbroke 4168

RADIO & ELECTRONIC ENGINEERS . . .

The MORSE CODE is still, and always will be, the basic Code for individual Signalling, whether on visual or telecommunication circuits.
So add this simple and interesting subject to your qualifications. Apart from the pleasure derived from this extra knowledge, it counts for much when a step up the ladder is under consideration.
Write for the CANDLER BOOK OF FACTS and see for yourself how fascinating the Candler method of teaching the Morse Code will prove.

CANDLER SYSTEM CO.
(56W) 52b ABINGDON ROAD, LONDON W.8
Candler System Co., Denver, Colorado, U.S.A.

SITUATIONS VACANT

AN interesting vacancy occurs for a radio/TV engineer in small West Country coastal town. Permanent well-paid position; unfurnished flat available; would consider applicant with radio or electronics experience only; apply with full details to E. C. Vowles & Son (T.V.) Ltd., High St., Portishead, Somerset. [7758

SENIOR Technician required immediately for engineer's department, physics workshop knowledge of electronics, physics and general workshop technique desirable; salary £600×£25—£775 p.a., plus London Weighting.—Write, stating age, qualifications and experience, to Chief Engineer, The Middlesex Hospital, W.1. [7719

SENIOR test engineer required to take charge of test department of expanding electronics company; H.N.C. standard required, with several years of practical experience also; salary commensurate with qualifications and experience.—Apply Winston Electronics, Ltd., Govett Ave., Shepperton, Middlesex. (Tel. Walton-on-Thames 6321.) [7754

RADIO Engineer, also T.V. Engineer required; not necessary driver for radio work; good wages; permanent position accommodation arranged if necessary; all main agencies held; Murphy-Pye-Bush-Eros; established 50 years.—Apply giving particulars of experience; all applications answered.—Victor Freed, 1 and 60, Cardiff St., Aberdare. Tel. 749. [7718

SKYWAYS, Ltd., require experienced radio mechanics at Stansted Airport for employment in workshops and on maintenance of engines in aircraft; applicants must be fully experienced, particularly in workshop practice; good rates of pay and conditions of service.—Apply with full details to Personnel Manager, Skyways, Ltd., Stansted Airport, Essex. [7596

ELECTRONIC Instrument Company require Sales Representatives resident in each of Birmingham, Bristol, Cardiff, Cambridge, Glasgow, Newcastle and Southampton; applicants should have good technical knowledge of electronic laboratory instruments and industrial equipment; write giving ful details of experience and salary required to Personnel Officer, Airmec Limited, High Wycombe, Bucks. [7706

RADIO and Television.—Chargehand electrical fitter required for radio and television duties at Spring Gardens, Ditherington, Shrewsbury; must be experienced in the repair and maintenance of all types of radio and television receivers; present rate of pay 4/10½d per hour; N.J.I.C. conditions.—Apply, by letter, to District Manager, Midlands Electricity Board, 45, High St., Shrewsbury. [7724

A WELL-KNOWN electro-acoustic engineers situated S.E. London require a supervisor for their assembly department; whilst previous experience in the manufacture of loudspeakers and microphones would be useful, it is mbre important that the applicant should display keenness and initiative and also possess the ability to control female staff.—Particulars of previous experience and wages required to Box 4602. [7745

ELECTRONIC development engineer required by small but progressive company in West London (Twickenham) area; this position requires an engineer aged 25-35 possessing H.N.C. or equivalent with at least 2 years' post-H.N.C. development experience; ability to work with a minimum of supervision and exert leadership when necessary is essential; pension scheme and social activities.—Write, with full details career and salary required, to Box 4539. [7735

ELECTRICAL component manufacturers in N.W. London require keen and energetic man (30-55 years) to supervise small service department; applicants must be able to conduct correspondence, control manual and clerical staff and possess electrical engineering background; no Saturdays; superannuation scheme.—Write stating age, full details of experience and salary required, to Box 3ML.5425, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. [7682

CYCLOTRON operator trainee required by Medical Research Council for the cyclotron at Hammersmith Hospital; machine is engaged on radioisotope production and research with radiation; duties include assisting with development of machine for new projects, some knowledge of electrical control circuits essential; salary £620-£760 according to age and qualifications.—Apply, stating full details of experience, to Senior Cyclotron Engineer, Medical Research Council, Hammersmith Hospital, Ducane Rd., W.12. Shepherds Bush 4594. [7742

ELECTRONIC engineers are invited to apply for positions concerned with the maintenance and installation of large-scale digital computers; these positions are permanent and pensionable and afford excellent opportunities for rapid advancement in this young and expanding organisation; applicants should possess an engineering degree or equivalent qualification and should have some experience of pulse techniques; the next 4-month training course commences at the end of April.—Applicants should send brief details of experience and qualifications to: Personnel Officer, LEO Computers, Ltd., Minerva Rd., Park Royal, London, N.W.10. [7729

BARGAIN OFFERS

A. C. MOTORS. ¼ h.p. 230 volts a.c. 50 cycles s.p. 1,400 r.p.m. Capacitor start, foot mounting, **90/-**, carr. 5/-.

SYNCHRONOUS MOTOR UNITS. 200/250 volts 50 c/s, speed 1 r.p.m., clockwise rotation; totally enclosed in metal case, with 1in. driving spindle. New, **40/-**, post 1/9.

TEMPERATURE CONTROL OVENS. Admiralty pattern, 230 volts a.c., gives stability of 2 parts in a million, with suitable crystals. Fitted thermostat and thermometer, temp. adjustable 40-60° C. As new, lab. tested and guaranteed.

"S" METERS. 2in. square flush panel mounting. Suitable for AR88 or other receivers. New stock, **39/6**, post 1/6.

400 CYCLE INVERTERS. 24/28 volts d.c. input, dual output, 115 volts 3-phase 750 v.a. and 24/26 volts s.p. 250 v.a. New condition, lab. tested and guaranteed.

AMPLIFIERS. 4-channels 20 watts, 5 watts per channel. In one cabinet. Frequency response flat 40 c/s to 12 kc/s. Without valves, **39/6**, carr. extra.

THE DIXON-LESLEY HOLE CUTTER. For bench or portable drills ¼in. upwards. Tungsten-Cobalt H.S. steel teeth, removable for regrinding, ¼in. 1in., 1¼in., **25/-**. 1½in., 1¾in., 2in., **30/-**. Morse taper or ½in. straight shank Mandrels, **17/6**. Write for illustrated leaflet. Adjustable Hole Cutters, capacity 1in. to 7in., perfect rigididty, with lead screw for fine adjustment. Write for leaflet.

RATCHET COUNTERS. 5-digit with spring return, 2-hole mounting. New, **12/6**, post 8d.

ATTENUATORS. Variable 1 db to 80 db., accuracy 0.1 db. Input and output impedance 600 ohms. Lab. tested, as new; ideal for audio and carrier frequency measurements.

DECADE BOXES. Tinsley 4-arms, units to thousands; in wood box, **55/-**, carr. 3/6.

RELAYS. G.P.O. type 600. Coil res. 1,000 ohms, 2-C.O. contacts. **8/6** each, post 9d. G.P.O. Telephone Jacks **1/6**, post 6d.

Leslie Dixon & Co.
Dept. A, 214 Queenstown Road, London, S.W.8
Telephone: MACaulay **2159**

The NEW

EDDYSTONE '870'
RECEIVER

PRICE — **£34.16.0** *(inc. P.Tax)*

Efficient broadcast reception on short, medium and long waves. A Semi-portable AC/DC set equally suitable for cabin or home use, offering Eddystone design and workmanship at a Reasonable Price.

In stock at :—

WEBB'S RADIO
14 SOHO STREET, LONDON, W.1
Telephone GERrard 2089

WIREWOUND RESISTORS

Eureka wound on strip. 1 to 1,000 ohms: 1% **2/9**; 0.5% **3/-**; 0.2% **4/3**; 1K to 5K, 1% **3/3**; 0.5% **3/6**; 0.2% **4/9**. 5K to 20K, 1% **4/-**; 0.5% **4/3**; 0.2% **6/-**; 0.75W rating. Your value wound to order, quick delivery. Special quotation for quantities.

SHUNTS

Wire-ended Eureka shunts, three ranges, 1% accuracy, for inclusion in customers own apparatus. For 1 mA. 100 ohm meter, ranges 10, 100 1,000 mA. For 500 μA 500 ohm meter, ranges 5, 50, 500 mA. Price 8/6 each.

PLANET INSTRUMENT CO.
25, DOMINION AVENUE, LEEDS, 7.

(M.O.S. Release)
SPECIAL OFFER OF
DYNAMO EXPLODER Mk II

For detonating explosive charges. A must for mining, demolition, road building and construction operations. May also be adapted as photo-flash generator. Operated by hand generator giving 1,800 volts d.c. across o/p. terminals. *In hide leather case* (Usual price 17 gns.) Our Price **£3.19.6 each.** P. & P. 5/-.

AERIAL MASTS
R.A.F. TYPE 50
36ft. HIGH

Kits comprise—9 2in. dia. Tubular Steel (Copper Plated) Sections of 4ft. length, top-section and base. Pickets, Guys and Fittings.

YOU can purchase this normally expensive MAST for a fraction of its cost, i.e.,

£8.10.0 ONLY (Carr. 15/6).

Please add £1 for (returnable) wooden carrying case.

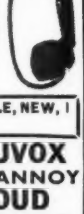
The MAST is particularly suitable to take aerials for Tx., Rx., F.M. and T.V. (especially COMMERCIAL), and has many other uses. Extra 4ft. sections can be supplied at **11/6** per section.

U.S.A. 45ft. AERIAL MAST (10 sections 4ft. 6in. x 2in., guys etc.). This entirely new and complete set in canvas carrying bag **£15/10/-** each, carr. 17/6 or 2 sets with additional low and high frequency antenna £30 pair. Carr. extra.

ARMY TYPE 32FT. MASTS similar to above but 10 lin. screw-sections, suitable for permanent lightweight installation. Kit in canvas bag, **£5/10/-**, carriage 12/6.

TELEPHONE SETS
IN ATTRACTIVE BAKELITE CASE
BRAND NEW EX-GOVT. "F" TYPE

Ideal between 2 or more positions up to five miles. STORE, FACTORY AND OFFICE: FARM BUILDINGS; GARDEN SHED and HOUSE. 2 sets in individual carrying cases, complete with **long life batteries, bells, ringer and 100ft. telephone cable.**



£7.10.0 per pair Carr. (G.B.) 9/6.

D3 STRANDED TELEPHONE CABLE, NEW, 1 mile drum, **85/-**, carr. 17/6.

TRUVOX and TANNOY LOUD HAILERS
EX-GOVT.
Impedance 7½Ω
Handling cap. 8 watts price **25/-**, post 3/6. **45/-** pair carr. paid.

TELEPRINTER EQUIPMENT-Brand New
Creed Automatic Transmitter No. 6S4/N. Rect. Units 26B. I-P 110/230 v. O-P, 80+80 v.
Telegraph Relays 299 AN.
Creed Keyboard 7M. 3 Bank 5 Unit with answer-back unit.
7B Carriage Unit, stand. friction feed S1813. Also comprehensive range of spares.

Quantity and Export enquiries are invited for all above items, also other Electronic Component parts.

HATTER & DAVIS (RELAYS) LTD.
126 KENSAL ROAD, LONDON, W.10 LADbroke 0666

SITUATIONS VACANT

DESIGN engineer required for original development and design work on power magnetic/amplifiers and transformers, H.N.C. or equivalent coupled with design experience in this field; factory situate in Crawley New Town, Sussex; housing accommodation is available and there is a pension scheme if desired. —Apply in writing to: Hirst Electronic, Ltd., Gatwick Rd., Crawley, Sussex. [7646

THE LONDON HOSPITAL, Whitechapel, E.1, requires young man to assist with maintenance and construction of electronic apparatus in the department of electro-encephalography; previous experience not necessary, but familiarity with electronic techniques essential; starting salary according to age and experience, scale £210–£430 p.a.; continued study is encouraged and facilities will be provided for this.—Write to House Governor. [7737

SPECIALIST technician required to help in prototype medical electronic/mechanical instrument designing and construction; suitable qualifications for physics or equivalent with some laboratory experience and of audio and pulse techniques; age preferably 28-35; salary scale according to qualifications £640-£790 (inc. London weighting).—Application forms, to be returned within 7 days, from Secretary, Institute of Psychiatry, The Maudsley Hospital, Denmark Hill, S.E.5. (Ref. FPP.) [7734

INSTRUCTOR Grade I required by Posts and Telegraph Department, Nigeria Federal Government, on contract for one tour of 12/24 months in first instance; salary scale (including inducement addition) £1,536 rising to £1,674 a year; outfit allowance £60; free passages for officer and wife; assistance towards children's passages and grant up to £150 annually towards maintenance in U.K.; liberal leave on full salary; candidates must be qualified training officer with experience in Carrier and Voice Frequency Telegraph equipment working on both line and radio; C. and G. certs. in Telecoms., Principles II and Line Transmission I an advantage.—Write to the Crown Agents, 4, Millbank, London, S.W.1.; state age, name in block letters, full qualifications and experience and quote M2C/41922/WF. [7712

WIRELESS operator mechanics required by Falkland Islands Dependencies Survey for service at isolated British Bases in Antarctic; must be able transmit and receive morse at 20 words a minute and be capable elementary maintenance wireless transmitting and receiving equipment; salary according age in scale £330, rising to £420 a year with all found, including clothing and canteen stores; keen young men between 20 and 30 years required, preferably single, of good education and high physical standard, with genuine interest in polar research and travel and willing to spend 30 months under conditions testing character and resource; successful candidates will sail in October.—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/42653/WF [7755

SITUATIONS WANTED

RADIO operator, 27, seeks position any capacity, U.K., or overseas.—Box 4699. [7760

AUTOMATIC Telephone and Telecommunications engineer; ex R.N.V.R.; seeks wider outlook.—Box No. 3867. [7670

ARE you needing representation for radio and electronic components? I have 12 years' experience and seek progressive position.—Box 4483. [7731

COMPANY director, experienced design, production and sales, electronics industry, seeks interesting change, management or sales.—Box 4521. [7732

CHIEF engineer of firm manufacturing radio and television receivers desires change; reasons are genuine but confidential; although a similar position is envisaged, any appointment will be considered where youthful enthusiasm coupled with specialised knowledge is a welcome asset.—Box 4545. [7738

TECHNICAL TRAINING

LEARN it as you do it—we provide practical equipment combined with instruction in radio, television, electricity, mechanics, chemistry, photography, etc.—Write for full details to E.M.I. Institutes, Dept. WW47, London, W.4. [0006

CITY and Guilds (Electrical, etc.) on "No Pass—No Fee" terms; over 95% successes; for full details of modern courses in all branches of electrical technology send for our 144-page handbook, free and post free.—B.I.E.T. (Dept. 388A), 29, Wright's Lane, London, W.8. [0017

TUITION

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt. page 156. [0172

FULL-TIME courses for P.M.G. Certificates, C.G.L.I. Telecommunications and Radar Maintenance Certificates.—Information from College of Technology, Hull. [0111

WIRELESS.—See the world as a radio officer in the Merchant Navy; short training period; low fees, scholarships, etc., available; boarding and day students; stamp for prospectus —Wireless College, Colwyn Bay. [0018

Smith's of EDGWARE ROAD

ELECTRONIC COMPONENTS DISTRIBUTORS FOR OVER 25 YEARS

FOUR-SIDED BLANK CHASSIS

Made in our own works from commercial quality half-hard aluminium of **16 s.w.g. thickness** these chassis will carry components of considerable weight and normally require no corner strengthening.
We are now able to supply **same day** any size of chassis in ½in. steps up to 17in. Depths 1", 1½", 1¾", 2", 2½", 2¾", 3", at the following rates:—

48 sq. in.*	4/-	176 sq. in.	8/-	364 sq. in.	12/-
80 sq. in.	5/-	208 sq. in.	9/-	336 sq. in.	13/-
112 sq. in.	6/-	240 sq. in.	10/-	368 sq. in.	14/-
144 sq. in.	7/-	272 sq. in.	11/-	and pro rata.	

Post 1/8 Post 1/6 Post 1/9
(*Length plus twice depth × width plus twice depth)

STOCK SIZES

6"×4"×2" **5/-**. 7"×5"×2" **5/6**. 10"×4"×2½" **6/9**. 9"×7"×2" **7/-**. 12"×4"×2½" **7/3**. 10"×8"×2½" **8/6**. 12"×5"×3" **8/6**. 12"×7"×2½" **8/9**. 13"×8"×2½" **9/9**. 14"×7"×3" **10/6**. 14"×10"×2½" **11/6** 15"×10"×2½" **11/9**. 17"×10"×3" **14/-**.

½in. flanges on two sides (inside or outside) **1/6** extra. Soldered corners (new process) 2/- extra.
Panels **any** size up to 3ft. at **4/6** sq. ft. (sq. in. × ¼ d.).
Full particulars on request.

Close Tolerance Wax-protected Silver Mica CAPACITORS

Values stock (pF):—

5	22	47	75	130	180	270	370	515	635	815	3000
10	25	50	80	135	200	280	386	533	670	820	3300
11	27	56	82	140	220	300	400	540	680	1000	3500
13	28	60	100	145	225	316	410	556	703	1500	4000
15	30	65	110	150	230	330	450	560	710	2000	4700
18	33	68	120	160	245	340	470	600	750	2200	5000
20	40	70	125	175	250	356	500	603	800	2500.	

Tol · up to 33pF 1pF, over 33pF 1 per cent.

PRICES: 5-200 pF **9d.**; 210-820 pF **10½d.**; 1,000-2,500 pF **1/3**; 3,000-5,000 pF **1/6**.
Special (limited number only), 0.1 mfd. 1% **12/-**.

***DALY** guaranteed **ELECTROLYTICS**
Full range from **1/6** ea.

***HIGH STABILITY RESISTORS.** "T.S.L." ½-watt 10% tol., 5-year guarantee. Full "preferred value" range, 12Ω to 10MΩ, **6d.** each. Pairs matched to within 2%, **3/-** pair.

***SURPLUS STOCKS,** various makes:—

	5%	2%	1%
¼ watt	7½d.	10d.	1/3
½ watt	9d.	1/-	1/6
1 watt	10½d.	1/3	1/9

***"ELECTROVOICE"** guaranteed **TRANSFORMERS AND CHOKES.** Individually tested. Fully shrouded. Used by leading laboratories 66 types in stock.

The COOPER-SMITH HIGH FIDELITY AMPLIFIER

Model BP1 Main Amplifier, **£14/17/-**. Build-it-yourself, **£12/12/-**. Mk. II Pre-amp. and Control Unit, **£11/3/-**. Build-it-yourself **£8/3/-**.
DIRECT FROM MAKER TO USER
A better 10 watt amplifier at lower cost. Send for illustrated details of this remarkable outfit or hear it in our demonstration room
Other Hi-Fi equipment includes Acoustical, Leak Rogers Lowther, Goodmans Wharfedale Lorens, Philips Connoisseur Collaro Garrard Goldring.

RELAYS 600 type **3/6** each.
2-make, 3000Ω coil
1-make, 1 c/o, 150Ω coil.
1-break, 1 c/o 1 c/o (M before B) 150Ω coil

VISUAL INDICATORS, type 3 (100/4) containing two micro-amp movements. Brand new **6/6** each With neon lamps (two) **9/6.**

MANSBRIDGE CAPACITORS, 200 V. D.C. wkg. Suitable for crossover units, etc. .5 mF **4d.** each; 1 mF **6d.** each; 2 mF., **6d.** each; 4 mF., **9d.** each.

LIGHTWEIGHT HEADPHONES: 2,000Ω **12/6** pr. 4,000Ω **17/6** pr.

★ NEW LINE

By arrangement with the Makers, we are now distributors for a full (preferred value) range of new wire ended

WIRE WOUND RESISTORS

1 watt (nominal) 5.6Ω to 560Ω **1/2** to **1/4** ea.
3 watts („) 5.6Ω to 1,500Ω **1/4** to **1/6** ea.
5 watts („) 5.6Ω to 3,300Ω **1/5** to **1/7** ea.
(Maximum wattage = double the above)
32 values in stock.

Trade enquiries invited.

Please add approx cost of postage.
*Lists available

H. L. SMITH & CO. LTD
287/289 EDGWARE ROAD, LONDON, W.2
Telephone Paddington 5891

CABINETS for EQUIPMENT, SPEAKERS and RECORDS by STAMFORD

GP 43 — 3ft. wide

Hi-Fi FOR THOSE WITH LIMITED SPACE

We have designed a special cabinet capable of correctly housing Hi-Fi equipment and embodying a FULL SIZE BASS REFLEX ENCLOSURE built to Goodmans specification for their 8in. Axiette speaker, using ¾in. chipboard, acoustically lined and quilted. Other features include:

(1) Large amplifier compartment 10 × 13in., well ventilated

(2) Control panel 15½ × 12in. high.

(3) ¾in. motor board 17 × 14in.

(4) Record storage for approx. 60 12in. L.P. Can be supplied completely fitted with the equipment of your choice.

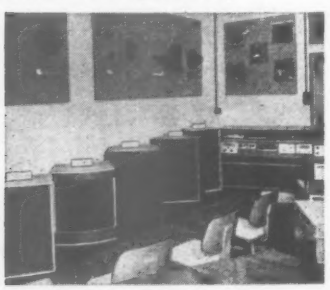
(5) Grill faced with TYGAN.

Price £18/18/- or 58/- deposit and 9 monthly payments of 38/6.

DEMONSTRATED AT OUR SHOWROOM, fitted with Lenco transcription unit, Rogers Junior amplifier, FM and Goodmans Axiette.

These cabinets are supplied in Oak, Walnut and Mahogany veneers finished to shade required. Delivery 12/6 in England and Wales. Scotland and N. Ireland 25/-.
Write for Catalogue of Equipment and cabinets for EQUIPMENT, RECORDS, SPEAKERS and PYE BLACK BOX. Satisfaction guaranteed or money refunded.

Demonstrations of:
LOUDSPEAKERS: The Goodmans Range, Wharfedale, G.E.C., Duode, Lorenz.
GRAMOPHONE UNITS: Garrard 301, Connoisseur, Lenco.
AMPLIFIERS AND CONTROL UNITS: Acoustical, Quad II, Leak, Rogers and Armstrong.
TAPE: Sonomax, Adaptotape, Collaro.
F.M. TUNERS: Leak, Rogers, Armstrong.



Demonstrated at our New Showroom:
98 WEYMOUTH TERRACE,
(Off Hackney Road), LONDON, E.2
Telephone: SHO 5008

Hours: 9.30 a.m. to 5.30 p.m. Mon., Tues., Fri., Sat.
Wednesday: 9.30 a.m. to 7 p.m.
Thursday: 9.30 a.m. to 1 p.m.

No. 6 Bus from the AUDIO FAIR or LIVERPOOL ST. Book to the Odeon, Hackney Road and walk back two turnings.

Correspondence only, to:

A. L. STAMFORD (Dept. Y4)

28 College Parade, Salusbury Road, London, N.W.6.

TUITION

T/V and Radio.—A.M.Brit.I.R.E., City and Guilds, R.T.E.B Cert., etc. on "No Pass—No Fee" terms: over 95% successes: details of exams and home training courses in all branches of radio and T/V write for 144-page handbook—free.—B.I.E.T. (Dept 397A) 29, Wright's Lane, London, W.8 [0116

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "No Pass—No Fee" terms ...ver 95% successes—or details of exams and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free. B.I.E.T. (Dept. 387B), 29, Wright's Lane London W.8. [0118

ALL examinations easier to pass by I.C.S. home-study methods. A.M.Brit.I.R.E., C. & G. Telecoms., P.M.G. Cert. in Wireless Telegraphy, Radio and TV Servicing, etc.—Write for free prospectus: International Correspondence Schools, 71, Kingsway (Dept. L142), London, W.C.2. [0055

LEARN-AS-YOU-BUILD course in basic radio, electronic and electrical theory, with practical training, building a 4-valve receiver and superhet signal generator and multi-tester.—Write for free book: International Correspondence Schools, 71, Kingsway (Dept. L142), London, W.C.2. [0050

TRAIN at home for a better position or a new hobby.—We offer comprehensive modern home tuition courses covering over 100 careers and hobbies, practical equipment supplied with many courses.—Write for free brochure, stating subject of interest, to E.M.I. Institutes, Dept. Ww39, London, W.4. (Associated with H.M.V.) [0100

A.M.I.P.R.E.—for details of suitable study courses (only a limited number of students accepted), send for free syllabus of instructional text, I.P.R.E., conditions of membership, booklet 1/-; "The Practical Radio Engineer," journal, sample copy 2/3; 6,000 alignment peaks for superhets, 6/-.—All post free from Secretary I.P.R.E., 20, Fairfield Rd., London, N.8 [0086

FREE!—Brochure giving details of home study training in radio, television and all branches of electronics, courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other professional examinations, train with the college operated by Britain's largest electronics organisation, moderate fees.—Write to E.M.I. Institutes, Dept. Ww2d, London W.4. [0179

BUSINESS & PROPERTY

WEST Surrey, main road position; new shops to be erected, frontage 24ft. 6in., depth 50ft., cloakroom; self-cont. acc.: lounge, kit., 3 bed., bath; gas available, freehold £4,500; sole agents Timmis & Fisher, Maybury House, Frimley Te., Camberley 2292/3. [0116

BOOKS, INSTRUCTIONS, ETC.

"ABACS or Nomograms." By A. Giet. Translated from the French by H. D. Phippen and J. W. Head. Most engineers have made use of nomograms at some time in their careers, and are fully alive to the fact that they are a very convenient tool when the same formula has to be solved repeatedly for several sets of variables. It is fair to say, however, that only a small proportion of even those who habitually employ nomograms know how to construct them for their own use. Most of the comparatively small literature on the subject is written for mathematicians and is extremely difficult for the practical engineer to comprehend. This book is essentially practical, and not only demonstrates the many and varied applications of the abac or nomogram, but shows how even those without highly specialized mathematical knowledge may construct their own charts. 35/- net. From all booksellers. By post 36/- from the publishers: Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"TELEVISION Explained." By W. E. Miller, M.A. (Cantab), M.Brit.I.R.E. Revised by E. A. W. Spreadbury, M.Brit.I.R.E. The sixth edition of a book which assumes a knowledge of the ordinary sound radio receiver, but no previous knowledge of television circuits. It is non-mathematical, written in simple language and comprehensively illustrated by many diagrams and photographs. It will prove of great assistance to all students of television, to radio service engineers who wish to embark upon television work and want to understand the principles and circuits involved, and to knowledgeable owners of television receivers who would like to understand the working of their set. 12/6 net from all booksellers. By post 13/5 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"SECOND Thoughts on Radio Theory." By Cathode Ray of WIRELESS WORLD. Forty-four articles reprinted from popular WIRELESS WORLD series, in which the author examines various aspects of elementary radio science, explains them clearly, and shows that there may be more behind them than is apparent from the usual text-book. This volume deals with basic ideas: circuit elements and techniques; circuit calculations; and some matters in lighter mood. An entertaining and helpful text-book for the student, refresher course for the engineer, and reference book for all combined; 25/- net from all booksellers. By post 26/4 from Iliffe & Sons Ltd., Dorset House, Stamford St., S.E.1.

Smiths Aircraft Instruments Ltd.

have following vacancies for

SENIOR AND JUNIOR ENGINEERS

(i) To develop flight instruments, flowmeters, capsules, diaphragms, remote reading pressure gauges and ancillary equipment. Ref. No. 128/B.P./WW.

(ii) To design and develop electromechanical instruments, miniature A.C. motors, A.C. tacho generators, moving coil instruments. Ref. No. 129/EI/WW.

(iii) For design, development and prototype testing of electromechanical and mechanical instruments and servomechanisms. Ref. No. 130/MD/WW.

(iv) For liaison between Production and Design staffs on wide range of electromechanical precision instruments. Ref. No. 131/PL(EM)/WW.

(v) For design and development of gyroscopes and gyroscopic devices and stabilized platforms. Ref. No. 132/SMI/WW.

(vi) For laboratory work on electronic components of all kinds which may be used in airborne instruments and equipment. Ref. No. 133/CG/WW.

(vii) For detail circuit design of magnetic amplifiers and transistor amplifiers. Ref. No. 134/EE/WW.

(viii) For design and development of electronic and electromechanical test equipment. Ref. No. 135/TE/WW.

(ix) For liaison between Production and Design staffs on magnetic amplifiers, transistor amplifiers and general electronic equipment. Ref. No. 136/PL(E)/WW.

(x) For design and development of systems concerned with automatic control of aircraft. Ref. No. 137/SEL/WW.

(xi) For calibration of mechanical and electrical test equipment, and investigation of defective instruments. Ref. No. 138/TS/WW.

(xii) For designing and carrying out laboratory tests in the field of instrument mechanisms; experience of stress and vibration problems an advantage. Ref. No. 139/RMA/WW.

(xiii) For development of insulating systems in light engineering applications. Ref. No. 140/MRL/WW.

(xiv) To conduct experiments for verification of new ideas, particularly relating to control systems. Ref. No. 141/ER/WW.

Candidates for senior posts are expected to have a University Degree and/or H.N.C. For the junior posts, O.N.C. acceptable. Proven experience in one or more fields indicated would be an alternative to academic qualifications. Salary commensurate with qualifications and experience. Staff pension scheme. Write for application form, quoting appropriate reference, to **Personnel Manager,**

Smiths Aircraft Instruments Ltd.
Bishops Cleeve, Nr. Cheltenham, Glos.

METERS

WE CAN SUPPLY WITHIN 7-14 DAYS

a complete range of moving coil—moving iron—electrostatic—thermo-couple—also multirange meters—meggers—pyrometers and laboratory test instruments, etc.

All to B.S.89.

REPAIRS

Delivery 7-14 days

Our skilled craftsmen carry out repairs or convert any types and makes of single and multirange meters.

Where desired, repairs are accepted on contract.

THE V.Z. ELECTRICAL SERVICE

4, LISLE STREET, LONDON, W.C.2

Telephone: GERrard 4861

RADIO & TELEVISION COMPONENTS

We operate a prompt and efficient MAIL ORDER service.

3d. stamp only for catalogue.

James H. Martin & Co. Finsthwaite, Newby-Bridge, Ulverston. Lancashire.

RECORD PLAYERS

COLLARO AC.3/554. Three-speed, single player for A.C. mains 200/250 v. cream finish complete with turnover crystal pick-up. "T" type head. Strictly limited quantity at £8.19.6. plus 5/6 carr

CRYSTAL PICK-UPS fitted Acos HGP37 cartridge. Ultra lightweight. Our Price 37/6. plus 2/6 carr.

3-SPEED RECORD PLAYERS. Fitted with Acos turnover HGP59 pick-ups with twin sapphire styli, rexine case with lid, fitted clamps and handle. Worth 10 gns. Our Price £7/15/6. plus 5/6 carr

3-SPEED GRAM. MOTORS complete with crystal pick-up. Our Price 79/6. plus 5/6 carr.

REXINE COVERED CABINETS. Table player size, suitable most non-auto units including transcription motors. (Motor board uncut.) Our Price 46/6. plus 5/6 carr.

PORTABLE RECORD PLAYER CABINETS to house Monarch, Collaro or Garrard 120 Changers, with space for Amplifier and Speaker. Rexine finish in attractive colours. Fitted catches and handles. Our Price £3/5/- plus 5/6 carr.

Send stamp for complete bargain list.

RONALD WILSON & CO.

DEPT. W.W.1, 12 BRIDGE STREET, WORCESTER

ENGINEERS

Vacancies exist in the modern radio and television laboratories of a company situated in Eastern London for engineers of all grades. Projects include the development of home and export television, radio and car radio including printed circuit and transistor applications. Generous salaries will be paid to suitably qualified applicants. Staff canteen facilities available and superannuation scheme in operation. Please reply in confidence giving full details of qualifications and experience to Box No. 4653 c/o "Wireless World."

VALVES URGENTLY REQUIRED

866 Rectifiers
805 Triodes

Write or telephone:

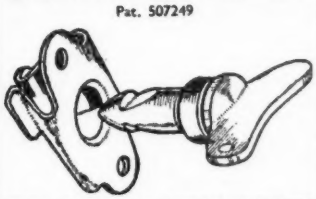
THE R.F. DEVELOPMENT CO. LTD.

PRIORY LANE, ST. NEOTS, HUNTS.

Day Tel.: St. Neots 506
Evening: St. Neots 586

ODDIE FASTENERS

Pat. 507249



THE FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES. SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS. WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochure and other information will gladly be sent on request.

DEPT. "W.W."

Oddie, Bradbury & Cull Ltd., Southampton

Tel.: 55883 Cables: Fasteners, Southampton

TRUVOICE DYNAMIC Microphone

MULTI-PURPOSE MICROPHONE

A new omni-directional precision built pressure microphone, available either as a high or low impedance model. Its frequency response is substantially flat from 100 to 13,000 c.p.s. Output level—57db at high impedance. 3 way usage, as a hand mike, floor stand, or table base stand.

Available from all dealers

£8.8.0

Selmer 114 Charing Cross Road, LONDON W.C.2

NORTHERN POLYTECHNIC, HOLLOWAY, LONDON, N.7

The Governing Body invite immediate applications for appointment as

Lecturer in Telecommunications

to teach up to the Full Technological Certificate of the City & Guilds of London Institute and the Grad.Brit.I.R.E. Facilities available for research. Salary scale—£1,200 × £30 —£1,350 plus London Allowance.

Apply for form of application and further particulars to the Clerk to the Governors.

A MAST PROBLEM? WRITE TO Skymasts

BEADON GARAGE BEADON ROAD LONDON W6 Telephone RIVerside 1124 and 7071

INDEX TO ADVERTISERS

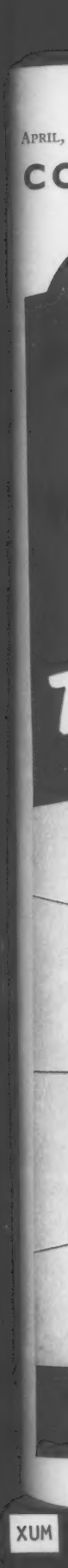
	Page
Abix (Metal Industries), Ltd.	166
Acoustical Mfg. Co., Ltd.	8
Adcola Products, Ltd.	54
Adler, B., & Sons (Radio), Ltd.	174
A.D.S. Relays, Ltd.	52
Advance Components, Ltd.	4
Aero Research, Ltd.	47
Alpha Radio Supply Co., The	164, 165
Alto Bass, Ltd.	133
Amphenol, Ltd.	86
Amplex Appliances (Kent), Ltd.	134
Amplivox, Ltd.	40
Anders Electronics, Ltd.	132
Antex, Ltd.	68
Antiference, Ltd.	17
Appointments Vacant	185, 186, 187, 196, 197
Arcolectric Switches, Ltd.	56
Ardente Acoustic Laboratories, Ltd.	116
Armstrong Wireless & Television Co., Ltd.	66, 191
Aspden, W.	192
Automat	76
Avinash (Electronics), Ltd.	182
Avo, Ltd.	1
Baker's "Selhurst" Radio	152
Beamish, V.	192
Belling & Lee, Ltd.	101
Benson, W. A.	190
Berry's (Short Wave), Ltd.	89
Bestfend Electrical Co., Ltd.	182
Bird, S. B., & Sons, Ltd.	77
Birmingham Sound Reproducers, Ltd.	106
Bradmatic, Ltd.	170
Bradmatic Productions, Ltd.	183
Britain, Chas. (Radio), Ltd.	161
British Communications Corporation, Ltd.	61
British Institute of Engineering Technology	172, 178
British Insulated Callender's Cables, Ltd.	Cover ii
British National Radio School	136
British Physical Laboratories	6
British Sarcoal, Ltd.	183, 187
Brookes Crystals, Ltd.	162
Brown, S. G., Ltd.	84
Bulgin, A. F., & Co., Ltd.	Edit. 201
Bullers, Ltd.	78
Burne Jones & Co., Ltd.	114
Candler System Co.	194
Cardross Engineering Co., Ltd.	190
Carr Fastener Co., Ltd.	21
Champion Products	174
Chapman, C. T. (Reproducers), Ltd.	54
Cinema Television, Ltd.	26, 121
City Sale & Exchange, Ltd.	60
Classic Electrical Co., Ltd.	126
Clyne Radio, Ltd.	142, 143
Cosmocord, Ltd.	100
Cossor Instruments, Ltd.	73
Coventry Radio	184
Daly (Condensers), Ltd.	82
Davies, A., & Co.	178
Davis, Jack (Relays), Ltd.	70
De Havilland Propellors, Ltd.	185
Denco (Clacton), Ltd.	74
Dependable Radio Supplies, Ltd.	136
Direct T.V. Replacements	178
Dixon, L., & Co.	194
Duke & Co.	168
Dulci Co., Ltd., The	60, 134
Drayton Regulator & Instrument Co., Ltd.	72
Dubilier Condenser Co. (1925), Ltd.	117
Duode Natural Reproducers	174
Dynatron Radio, Ltd.	54, 76
Eddy's (N'tham), Ltd.	166
Eeen Electric, Ltd.	88
E.I.R. Instruments, Ltd.	124, 194
Electro-Acoustic Developments	170
Electro-Acoustic Industries, Ltd.	57
Electro-Methods, Ltd.	23, 43
Electronic Precision Equipment	112, 113
Electronic Technical Service	114
Electronic Tubes, Ltd	79
Electronics (Fleet Street), Ltd.	146, 147
Electro-Winds, Ltd.	126
Elliott Bros. (London), Ltd.	35, 186
E.M.G. Handmade Gramophones, Ltd.	18
E.M.I. College	110
E.M.I. Electronics, Ltd.	103
E.M.I. Institutes	105, 108, 186
E.M.I. Sales & Service, Ltd.	19
English Electric Co., Ltd.	44, 185, 187
English Electric Valve Co., Ltd.	5
English Electric Valve Co., Ltd.	32A
Ever Ready Co (G.B.), Ltd., The	50
Fairey Aviation, Ltd.	186
Feigate Radio, Ltd.	152
Ferranti, Ltd.	15, 180
Filmer, J. T.	180
Forrest, H. W. (Transformers), Ltd.	184
Foyle, W. & G., Ltd.	180
Fringevision, Ltd.	126
Frith Radiocraft, Ltd.	178
Garrard Eng. & Mfg. Co., Ltd., The	90
Gee Bros., Radio, Ltd.	175
General Electric Co., Ltd.	63, 137, 185
German Industries Fair	163
Gilfillan, R., & Co., Ltd.	174
Gilson, R. F., Ltd.	193
Gladstone Radio	158
Glaser, L. & Co.	182
Goldring Manufacturing (Gt. Britain), Ltd.	14
Goodmans Industries, Ltd.	42
Gowllands Ltd	136
Grampian Reproducers, Ltd.	58
Grayshaw Instruments	152
Griffiths Hansen (Recordings), Ltd.	180
Hall Electric, Ltd.	24
Hanney, L. F.	190
Harding Electronics	184
Harmsworth, Townley & Co.	172, 184
Harris Electronics (London), Ltd.	157
Harris, P.	190
Hatter & Davis, Ltd.	165, 195
Henley's, W. T., Telegraph Works Co., Ltd.	184
Henry's (Radio) Ltd.	158, 159
Hewlett-Packard Co.	91
Hinchley Engineering Co., Ltd.	12
Hivac, Ltd.	32D
Hivac, Ltd.	62
Home Radio, Ltd	162
H.P. Radio Services, Ltd.	90
Hunt, A. H. (Capacitators), Ltd.	71
Hunton, Ltd.	9
I.E.A. Exhibition	62
Iliffe & Sons, Ltd.	32, 156, 162, 168 178
Iliffe & Sons Ltd.	64D
International Correspondence Schools	156
Jackson Bros. (London), Ltd.	64
Jason Motor & Electronic Co.	134
Jeffery Transformer Co.	184
Kenroy, Ltd.	192
Keyswitch Co., The	68
Kolectric, Ltd.	70
Lasky's Radio, Ltd.	149, 150, 151
Leak, H. J., & Co., Ltd.	111
Leevers-Rich Equipment, Ltd.	116
Levell Electronics	86
Lewis Radio Co.	78, 122
Light Soldering Developments, Ltd.	182
Linear Products, Ltd.	177
Lionnet, J., & Co.	152
Lockwood & Co. (Woodworkers), Ltd.	180
London Audio Fair	56
London Central Radio Stores	92
Long Playing Record Library	163
L. R. Supply Co., Ltd.	167
Lyons Radio Ltd.	182
Magnetic Devices, Ltd.	115, 123
Mail Order Supply Co.	124
Marconi Instruments, Ltd.	38, 39
Marconi Instruments, Ltd.	64B
Marconi's Wireless Telegraph Co., Ltd.	102, 180, 187
Marriott, R., & Co., Ltd.	90
Martin, J. H.	197
McMurdo Instruments Co., Ltd.	41, 72, 128
Mechanical Handling Exhibition	179
Mercia Enterprises, Ltd.	128
Mersey Cable Works	118
Microwave Instruments	184
Midland Instrument Co.	156
Mills, W.	168
Ministry of Transport	186
Minnesota Mining & Mfg. Co., Ltd.	162
Modern Book Co.	170
Modern Electrics, Ltd.	167
Modern Techniques	120
M.O. Valve Co., Ltd.	187
M.R. Supplies, Ltd.	84
M.S.S. Recording Co., Ltd.	82
Mullard, Ltd.	3, 36, 37, 46, 98, 125, 185
Mullard, Ltd.	64A
Multicore Solders, Ltd.	Cover iv
Multitone Electric Co., Ltd.	53, 186
Murex, Ltd.	68
Nash & Thompson, Ltd.	34
Newnes, George, Ltd.	11
Northern Polytechnic	197
Northern Radio Services	131
Oddie, Bradbury & Cull, Ltd.	197
Osmor Radio Products, Ltd.	130
Oxley Developments Co.	172
Palmer, G. A. Stanley, Ltd.	120
Parker, A. B.	130
Partridge Transformers, Ltd.	189
P.C.A. Radio	160
P.C. Radio	160
Pearce, T. W.	192
Period High Fidelity, Ltd	28
Philips Electrical, Ltd.	80
Planet Instrument Co.	194
Plasticable, Ltd.	126
Plessey Co., Ltd.	10, 31, 129
Plessey Electronics, Ltd.	127
Post Radio Supplies	182
Premier Radio Co.	92, 93, 94
Preston, A., & Sons	172
Proops Bros., Ltd.	140, 141
Pye, Ltd.	45
Pye Telecommunications, Ltd.	96
Quartz Crystal Co., Ltd.	184
Radiation Monitors, Ltd.	66
Radio & T.V. Components (Acton), Ltd.	181
Radio Clearance, Ltd.	148
Radio Component Specialists	171
Radio Exchange Co., The	180
Radio Experimental Products Co.	182
Radio Ham Shack, Ltd.	134
Radio Industry Council	33
Radio Resistor, Ltd.	29
Radio Servicing Co.	130
Radiospares, Ltd.	86
Radio Supply Co. (Leeds), Ltd.	138, 139
Radio Traders, Ltd.	176
Ranton & Co., Ltd.	95
RCA, Great Britain, Ltd.	25
Record Housing	130
Redifon, Ltd.	180
Reida Radio, Ltd.	168
Reliance Manufacturing Co., Ltd.	170
Reproducers & Amplifiers, Ltd.	67
R.F. Development Co., Ltd.	197
Rogers Development (Electronics), Ltd.	80
Rollett, H., & Co., Ltd.	192
Salford Electrical Instruments, Ltd.	136
Samsons Surplus Stores	158
Sangamo-Weston, Ltd.	110
Savage Transformers, Ltd.	191
Selmer	197
Semiconductors, Ltd.	59
Service Trading Co.	173
Sexton, J. E., Ltd.	132
Shape, H.Q.	185
Sherwood Instruments	178
Siemens & Halske Aktiengeselischaft	85
Siemens Edison-Swan, Ltd.	51, 104, 107
Sifam Electrical Instrument Co., Ltd.	178
Simmonds, L. E., Ltd.	64
Skymasts	48, 49, 197
Smith's Aircraft Instruments, Ltd.	196
Smith, G. W. (Radio), Ltd.	144, 145
Smith, H. L., & Co., Ltd.	195
Solartron Electronic Group, Ltd.	2
Sonomag, Ltd.	178
Southern Radio Supply, Ltd.	170
Southern Technical Supplies	178
Specialist Switches	172
Spencer-West, Ltd.	184
Sperry Gyroscope Co., Ltd.	13
Stamford, A. L.	196
Standard Telephones & Cables, Ltd.	32B
Standard Telephones & Cables, Ltd.	75, 96
Stern Radio, Ltd.	153, 154, 155
Stewart Transformers, Ltd.	132
Suflex, Ltd.	16
Sugden, A. R., & Co. (Engineers), Ltd.	64C
Sugden, A. R., & Co. (Engineers), Ltd.	65
Sutton Coldfield Electrical Engineers	120
Tannoy Products, Ltd.	22
Taylor Electrical, Ltd.	95
Technical Ceramics, Ltd.	81
Technical Trading Co.	166
Telegraph Condenser Co., Ltd.	Cover iii
Telegraph Construction & Maintenance Co., Ltd.	122
Telequipment, Ltd.	30
Tele-Radio (1943), Ltd.	182, 193
Teletron Co., The	180
Test Equipment Repair	128
Texas Instruments, Ltd.	69
Thomas, Richard & Baldwin, Ltd.	32C
Thorn Electrical Industries, Ltd.	27
Trix Electrical Co., Ltd.	Edit. 199
T.R.S. Radio	181
Truvox, Ltd	7
Universal Book Co.	184
Universal Electronics	135
Valradio, Ltd.	122
Venner Electronics, Ltd.	186
Verdik Sales, Ltd.	194
V.E.S. Wholesale Services, Ltd.	128
Vitavox, Ltd.	83
Vortexion, Ltd.	109
V.Z. Electrical Service	197
Walmore Electronics, Ltd.	88
Watts, Cecil E.	182
Wayne Kerr Laboratories, Ltd., The	119, 186
Webber, H. A., Ltd.	132
Webb's Radio	194
Weymouth Radio Mfg. Co., Ltd., The	124
Wharfedale Wireless Works	55
White, S. S., Co. of Gt. Britain, Ltd., The	20
Whiteley Electrical Radio Co., Ltd.	67
Wilkinson, L. (Croydon), Ltd.	176
Wilson, Ronald & Co., Ltd.	197
Woden Transformer Co., Ltd.	18
Wolsey Electronics, Ltd.	58
Wright & Weaire, Ltd.	74
Young, C. H.	167
Z. & I. Aero Services, Ltd.	188

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Paris Garden, London, S.E.1. *Wireless World* can be obtained abroad from the following: AUSTRALIA and NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd., William Dawson & Sons (S.A.), Ltd. UNITED STATES: Eastern News Co., 306 West 11th Street, New York 14.

Page
... 45
... 96
... 184
Ltd. 66
... 181
... 148
... 171
... 180
... 182
... 134
... 33
... 29
... 130
... 86
138, 139
... 176
... 95
... 25
... 130
... 180
... 169
... 170
... 87
... 197
... 80
... 192
... 136
... 158
... 110
... 191
... 197
... 58
... 173
... 132
... 185
... 178
... 85
104, 107
... 178
... 64
8, 49, 197
... 196
144, 145
... 195
... 2
... 178
... 170
... 178
... 172
... 184
... 13
... 196
... 32B
75, 99
154, 155
... 132
... 16
d. 64C
Ltd. 65
... 120
... 22
... 95
... 81
... 166
Cover iii
nance
... 122
... 30
182, 193
... 180
... 128
... 69
... 32C
... 27
Edit. 199
... 181
... 7
... 184
... 135
... 122
... 186
... 194
... 128
... 93
... 109
... 197
... 88
... 182
119, 186
... 132
... 194
he ... 124
... 55
Ltd.,
... 20
... 67
... 176
... 197
... 18
... 58
... 74
... 167
... 188

1. *Wireless*
Subscription
11th Street,

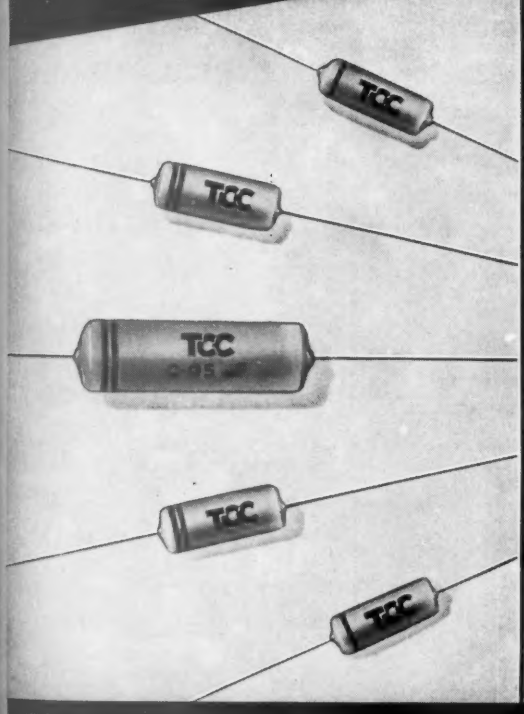
XUM


APRIL,
CO
XUM

CONDENSER SPECIALISTS SINCE 1906

TCC

PAPER TUBULARS



Our range of Wax Protected Tubular Paper Condensers, of which only a few are listed, is very comprehensive and includes types suitable for every possible application. They have many uses in radio circuits, amplifiers and electronic equipment where their non-inductive characteristics are of the greatest value, particularly at the higher frequencies.

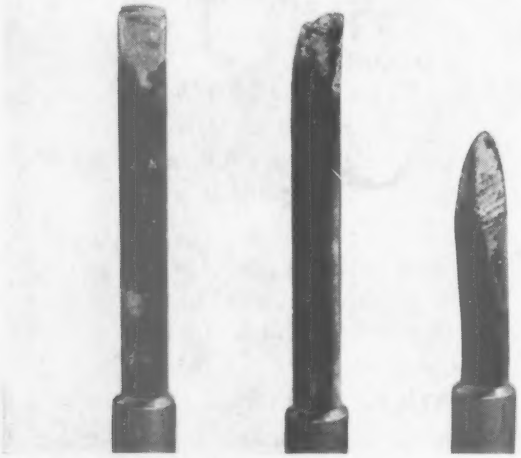
The units are wound with separate foil and papers, impregnated under vacuum, and finally immersed in high melting point wax to deter the ingress of moisture.

The miniature types are suitable for tropical use up to 85° C. when de-rated to 250 v. D.C. working.

Cap in μF.	D. C. Wkg. Voltage at 60° C.	Dimms. in ins. Lgth.	Diam.	T.C.C. Type No.	Price Each
·05	350	1¼	⅜	343	1/-
·1	350	1½	13/32	343	1/1
·2	350	1¾	17/32	343	1/4
·25	350	1¾	9/16	343	1/6
·0005	500	¾	3/16	543	-/10
·001	500	¾	3/16	543	-/10
·002	500	¾	3/16	543	-/10
·005	500	¾	¼	543	-/10
·01	500	¾	11/32	543	-/11
·02	500	1	11/32	543	1/-
·05	500	1½	7/16	543	1/2
·1	500	1½	9/16	543	1/3
·005	750	1	5/16	743	1/-
·01	750	1	11/32	743	1/1
·02	750	1	11/32	743	1/2
·05	750	1½	7/16	743	1/4
·1	750	1¾	9/16	743	1/6
·0005	1000	1	¼	2043	1/2
·001	1000	1	¼	2043	1/2
·002	1000	1	¼	2043	1/2
·005	1000	1	5/16	2043	1/2
·001	350	½	3/16	383	1/1
·002	350	½	3/16	383	1/1
·003	350	½	3/16	383	1/1
·005	350	½	7/32	383	1/3
·01	350	9/16	¼	383	1/3

Ersin Multicore Savbit TYPE 1 ALLOY

British Patent Nos. 704763, 721881



The bit on the left, used with Savbit Alloy, has made 10,000 joints. The centre bit, used for 1,000 joints, and the bit on the right for 7,500 joints, were used with a standard tin/lead alloy.

CUTS SOLDERING IRON REPLACEMENT COSTS

Many manufacturers have already changed to the exclusive use of SAVBIT Type 1 Alloy containing 5 cores of non-corrosive Ersin flux. Tests under actual working conditions have proved that the life of solder bits can be increased by up to 10 times by the use of SAVBIT Type 1 Alloy.

Savbit Type 1 Alloy is supplied on 7 lb. Reels for factory use. Ersin Multicore 5-core Solder is also available on these reels in 6 alloys and 9 gauges. Prices on application.

When each operative uses a comparatively small quantity of solder at a time, the 1 lb. Reel containing Savbit Type 1 Alloy is often the most convenient size. Containing approx. 170 ft. of 18 s.w.g.
15/- each (subject)

In addition to the normal 4 specifications of Ersin Multicore 5-core Solder, Savbit Type 1 Alloy is now also available in this pack for service engineers or radio enthusiasts. Contains approx. 53 ft. of 18 s.w.g.
5/- each (subject)

1958 R.E.C.M.F. EXHIBITION

These are some of the Multicore products which will be displayed on the Multicore Stand at the R.E.C.M.F. Exhibition at Grosvenor House from April 14 to 17. If you have any soldering problems and are unable to visit the Multicore Stand, please write to our Technical Service Department.

HOME CONSTRUCTOR'S 2/6 PACK

Contains 19 ft. of 18 s.w.g. 60/40 alloy wound on a reel. Also available containing 40 ft. of 22 s.w.g. 60/40 alloy — specially recommended for soldering printed circuits. 2/6 each (subject).

Bib WIRE STRIPPER AND CUTTER.

Strips insulation; cuts wires; splits plastic twin flex. Adjustable to most wire thicknesses. An ideal gift for handymen and electricians. 3/6 each (subject).

Bib RECORDING TAPE SPLICER.

This device enables professional and amateur recording enthusiasts to edit tape quickly, accurately and easily. Soon pays for itself by affording considerable economies in tape. 18/6 each (subject).

MULTICORE SOLDERS LIMITED, MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)

ent Nos.
721881

IRON
OSTS

already
use of
aining 5
in flux.
condi-
life of
by up to
SAVBIT

on to the
specifi-
of Ersin
e 5-core
Savbit
Alloy is
available
back for
engineers
enthusi-
ontains
53 ft. of

(subject)

TAPE

enables
ecording

OR 3636)

XUM